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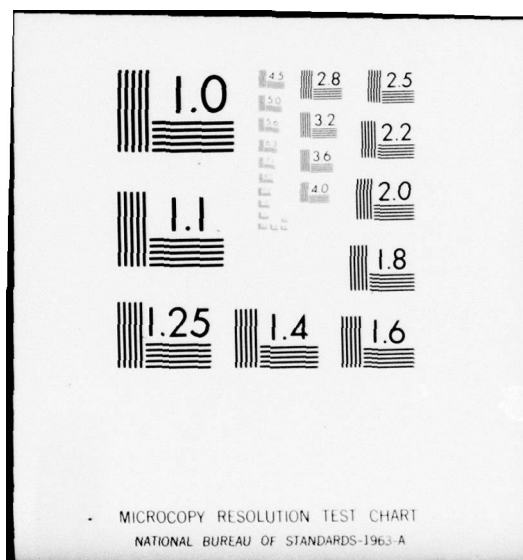
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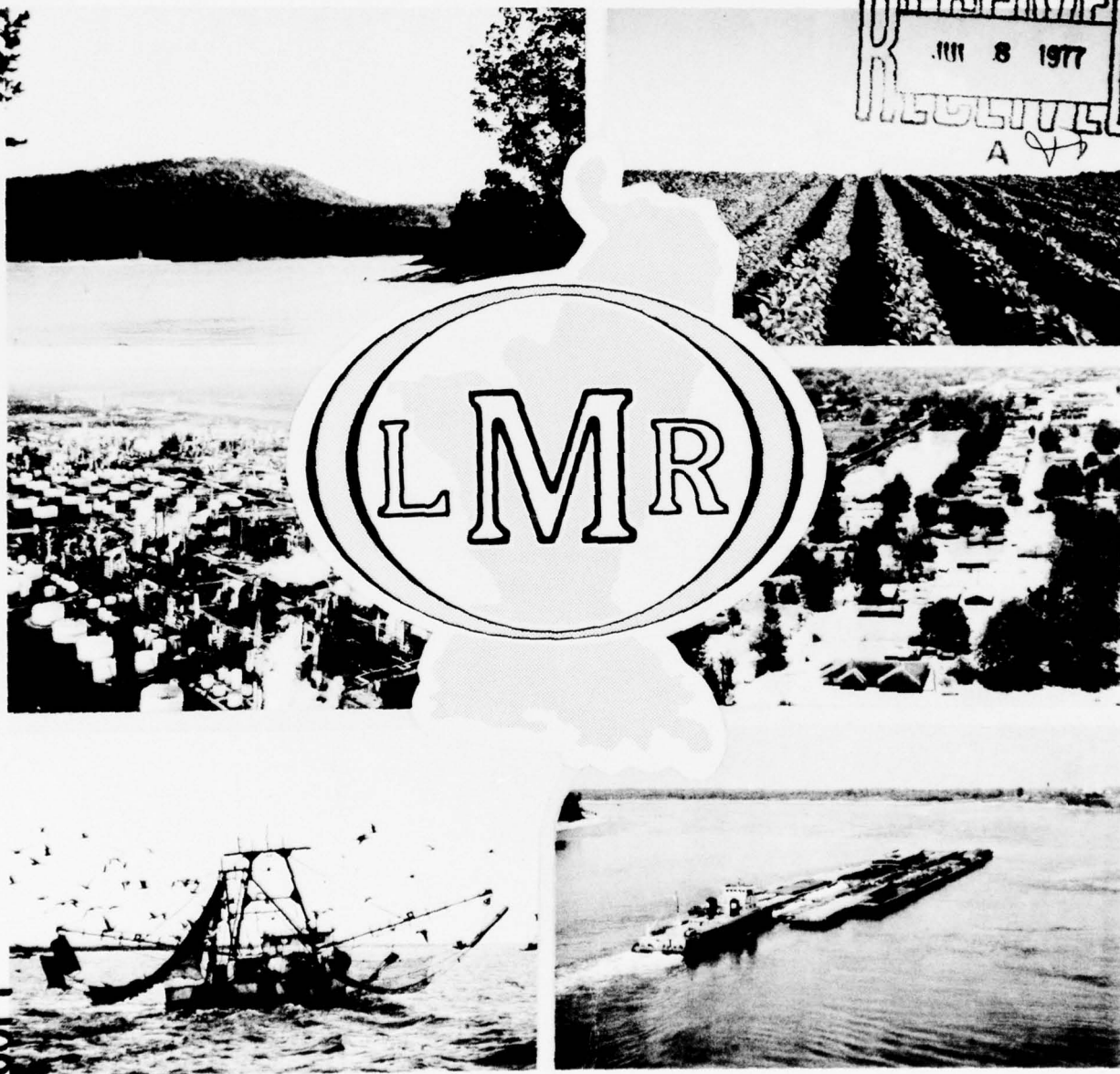
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This appendix is one of a series of 22 documents comprising the complete Lower Mississippi Region Comprehensive Study. A list of the documents is shown below.

Main Report

Appendixes

<u>Appendix</u>	<u>Description</u>	<u>Appendix</u>	<u>Description</u>
A	History of Study	K	M and I Water Supply
B	Economics	L	Water Quality and Pollution
C	Regional Climatology, Hydrology & Geology	M	Health Aspects
D	Inventory of Facilities	N	Recreation
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I	Agricultural Land Drainage	S	Sediment and Erosion
J	Navigation	T	Plan Formulation
		U	The Environment

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This report was prepared at field level by the Lower Mississippi Region Comprehensive Study Coordinating Committee and is subject to review by interested Federal agencies at the departmental level, by Governors of the affected States, and by the Water Resources Council prior to its transmittal to the President of the United States for his review and ultimate transmittal to the Congress for its consideration.

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PHOTOGRAPHS

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I N T R O D U C T I O N

PURPOSE

↙ The purpose of this appendix is to make a broad determination of the Lower Mississippi Region's navigation needs for the 50-year period 1970-2020, as analyzed under two objectives - that of national income and that of regional development. This assessment will point to the navigation problems and needs that can be expected to arise during the 50-year period of study. Determination can then be made of the proper means to solve such problems - whether it be deeper and wider waterways, new or larger locks, waterway extensions, improved harbor facilities, or offshore terminals.

SCOPE

↙ Historical and projected commerce evaluated in this study was limited only to the waterborne commerce moving in and through the region. Tonnage data used in the analysis were obtained for the base year 1970 from the Department of the Army, Corps of Engineers publication Waterborne Commerce of the United States (Part 2, 1970). ↗

PRESENTATION

In order to provide a practical basis for plan formulation, the region has been subdivided into ten water resource planning areas (WRPA's). The navigation needs for each of the subdivisions are presented separately in this appendix. The planning areas are as follows:

WRPA 1. The main stem of the Mississippi River below the mouth of the Ohio extending to and including the levees or to the top bank where levees do not exist.

WRPA 2. The St. Francis, Lower White, and Bayou Meto Basins, including the Arkansas River below Pine Bluff, Arkansas, and the St. Johns-New Madrid Floodway area.

WRPA 3. The basins in west Kentucky, west Tennessee, the Cairo area, and extreme north Mississippi.

WRPA 4. The Yazoo Basin.

- 1 -

WRPA 5. The Ouachita Basin, including the Lower Red River below Hot Wells, Louisiana.

WRPA 6. The Boeuf and Tensas Basin.

WRPA 7. The Big Black Basin and basins of southwest Mississippi streams that drain into the Mississippi River.

WRPA 8. The Baton Rouge area, including the drainage area of streams that flow into Lake Pontchartrain except for the Tchefuncta River and streams to the east.

WRPA 9. The Louisiana Coastal area from the east limits of the Atchafalaya Floodway to the Sabine River.

WRPA 10. The New Orleans area, including the Tchefuncta area and the area east of the Atchafalaya Floodway.

ASSUMPTIONS AND CONSTRAINTS

A determination of the intermodal distributions of existing and future commerce of the region would reflect the ideal situation. However, a comparative rate analysis of all transportation modes is not considered to be within the scope of a Type I study. Therefore, it is assumed that future rate structures will be such that water transportation will maintain at least its present proportion of the total commerce now moving in the Lower Mississippi Region.

RELATIONSHIP TO OTHER APPENDICES

The Navigation Appendix is related to all other appendices, but particularly with Appendices B, Economics, and D, Inventory of Facilities. Information developed in Appendix B, Economics, was used in the Navigation Appendix to project future growth of the region with respect to navigation requirements. Appendix D, Inventory of Facilities, is directly related to the Navigation Appendix as it provides information on port facilities along most of the major navigable waterways in the region. The Plan Formulation Appendix presents the programs to satisfy navigation needs.

REGIONAL SUMMARY

DESCRIPTION

The Lower Mississippi Region is an integral part of the great Mississippi River System which drains approximately 41 percent of the contiguous United States. In addition to drainage, the system provides the heartland of the United States with a vast network of shallow-draft navigation channels, measuring some 12,000 miles in length.

The hub of this inland waterway system is the main stem of the Mississippi River which has its origin in Lake Itasca, Minnesota, and flows in a southerly direction for over 2300 miles to the Gulf of Mexico.

Historically, the river has been divided into two sections, the Upper and Lower Mississippi River. The upper section extends 1366 miles from its source in Minnesota to Cairo, Illinois. The lower section, which traverses the entire length of the LMR, extends from the confluence of the Upper Mississippi and Ohio Rivers to the Gulf of Mexico, a distance of 974 miles.

In the Lower Mississippi Region, the main stem is an open channel during the entire year and is the main navigational artery for the Lower Mississippi Region's network of navigation feeder channels. It is maintained at a low-water depth of 9 feet and width of 300 feet from Cairo, Illinois, to Baton Rouge, Louisiana, a distance of 720 miles. Implementation of an authorized 12-foot deep channel is currently underway on this stretch of the river. From Baton Rouge to the Gulf of Mexico, the Mississippi River is maintained as a deep-water ship channel (40-foot controlling depth), thus affording the inland systems access to important transshipping points, such as Baton Rouge and New Orleans, Louisiana, for participation in world trade.

Additional deepwater channels along the region's coast contribute to a large volume of oceanborne commerce, both foreign and domestic. An alternate ship route is provided from New Orleans to the Gulf of Mexico via the 76-mile Mississippi River - Gulf Outlet (MR-GO) tidewater channel (36-by-500 feet). In the southwestern part of the region, the Port of Lake Charles, located on a 40-by-400 foot channel approximately 35 miles from the Gulf of Mexico, provides the oil refining and petrochemical plants in the area with deepwater access to the Gulf of Mexico.

The Gulf Intracoastal Waterway (GIWW), with a 12-foot minimum depth, complements the Mississippi River Systems by providing shallow-draft traffic access to all ports and connecting inland waterways between Florida and the Texas - Mexico border, a total distance over 1100 miles.

The 300-mile segment that traverses the entire coastal section of the Lower Mississippi Region is the hub of the GIWW. Besides being the geographical center, it is within this section where the GIWW intersects the Mississippi River at New Orleans.

Numerous access channels and harbors are maintained along the Louisiana coast to serve the ever-expanding offshore oil exploration in the Gulf of Mexico, as well as the growing seafood and menhaden industries' requirements. In addition to the access channels, a vast network of underwater pipelines provide transport for offshore oil to onshore installations.

Numerous other shallow-draft channels, which contribute greatly to its economic growth, are located within the region. Waterways such as the Arkansas, Wolf, Yazoo, and Arkansas - Black Rivers provide access not only to such ports as Pine Bluff, Arkansas; Memphis, Tennessee; Vicksburg, Mississippi; and Monroe, Louisiana; but convey large quantities of diverse commerce to the region's deep-draft ports. Detailed data on these waterways are presented in their respective WRPA's.

DEVELOPMENT

General

The Lower Mississippi Region, as well as a large segment of the United States, owes much of its development to the water transportation afforded by the Mississippi River. The river has been a past source of challenge and adventure for many, including the Indians who settled along its banks and early explorers such as Hernando DeSoto (1541), Pierre d'Iberville (1669), Louis Joliet and Father Jacques Marquette (1673), and Sieur LaSalle (1682). This mighty river has seen the passage of the early birch bark canoes of the Indians; the rafts, flatboats, and keelboats of the settlers and traders; the early side and stern-paddle wheel steamboats carrying freight and passengers; and today's modern diesel powered towboats with their multiple tows of up to 40 barges. While ocean-going vessels cannot go above Mile 225 at Baton Rouge, we have witnessed the arrival of the large barge-carrying ocean vessel whose special barges may well be found in the future at Tulsa, Oklahoma; St. Louis, Missouri; or up the Ohio River.

Early Commerce

New Orleans, founded in 1718, soon became the principal outlet for the early settlers due primarily to its location near the Gulf of Mexico. During the early years, the traffic was chiefly one-way (down river) and arrived by rafts, flatboats, and keelboats. These vessels brought such

items as pork, beef, flour, cheese, sugar, cotton, and whiskey.

By the turn of the nineteenth century, the problem of two-way traffic was solved. Robert Fulton, with his introduction of the steamboat "Clermont" in 1807, helped usher in a new era in water transportation. In 1812, the port of New Orleans welcomed the first steamboat (the "New Orleans") to ply the Mississippi River. After this, the port recorded 21 arrivals in 1814, nearly 200 in 1820, and more than 1000 in 1835. By 1850 there were nearly 3500 steamboat arrivals in New Orleans. Other ports in the region also flourished during this era. Large numbers of "cotton" boats plied the Mississippi River, taking on cargo at the ports of Memphis, Greenville, Vicksburg, and Natchez. Plantation landings, which lined the banks of the Yazoo and Red Rivers also accommodated large numbers of these steamboats; while streams such as the Arkansas, White, Ouachita, and Tallahatchie were utilized by the small packet boats to bring cotton and other cargo to market. The number of arrivals at these ports continued to increase until the 1880's, even though the Civil War had taken its toll of the packet fleet and the railroads had made great strides in becoming the chief mode of transportation of the nation's freight. But the heyday of steamboating on the river was over, and the glamour of such events as the famous Robert E. Lee - Natchez boat race (1870) was a thing of the past.

However, as the packet trade declined, the towboat industry, though small, was emerging as a source for continued transportation of freight by water. New towboats such as the sternwheeler "Sprague" (1902) helped to keep interest in water transportation alive. This vessel operated between Louisville, Ky., and New Orleans where it set a record in 1907 by pushing 60 coal barges totalling 67,307 tons. Today, the 71 year old craft is located in Vicksburg, Mississippi, where it serves as a major tourist attraction.

Interest by the Federal government in improving the waterways also gained impetus after the turn of the century. By 1929, a 9-foot minimum depth channel was being maintained between New Orleans and Pittsburg, Pennsylvania; and by 1940, a 9-foot channel was being maintained on the Upper Mississippi to Minneapolis, Minn., and on the Illinois River to Chicago, Illinois. Further interest was stimulated by the formation of the Federal Barge Lines to demonstrate to private operators the practicability and profitability of barge operations.

The combination of all these efforts proved successful. Waterway transportation showed a steady growth during the 1930's. The years following the outbreak of WW II produced a phenomenal growth which has continued to date. Modern towboats, ranging from 1,000 to 9,000 horsepower, can be seen pushing from one to as many as 40 or 50 barges in the Lower Mississippi region. Table 1 depicts this growth for several waterway reaches in the region, and table 2 shows the growth for some of the region's principal ports.

Table 1 - Regional Summary
Historical Data - Principal Waterway Reaches

<u>Waterway and Reach</u>	<u>1940</u>	<u>1950</u>	<u>Year</u> <u>1960</u>	<u>1970</u>
	(Thousand Short Tons)			
<u>MISSISSIPPI RIVER:</u>				
Mouth of Ohio River to but not including Baton Rouge, La.	7,056	22,058	40,150	85,883
Baton Rouge, La. to but not including New Orleans, La.	11,952	27,648	52,355	131,670
New Orleans, La. to Mouth of Mississippi River Passes	23,619	42,377	79,813	157,597
<u>GULF INTRACOASTAL WATERWAY:</u>				
Mississippi River, La. (New Orleans) to Sabine River, Tex. (Excluding Morgan City - Port Allen Route)	8,023	21,638	36,264	65,129

Table 2 - Regional Summary
Historical Data - Principal Ports

<u>Port</u>	<u>1920</u>	<u>1930</u>	<u>Year</u>		<u>1960</u>	<u>1970</u>
			<u>1940</u>	<u>1950</u>		
(Thousand Short Tons)						
Memphis, Tenn.	121	1,501	1,841	2,938	6,336	10,018
Vicksburg, Miss.	28	163	324	461	926	2,036
Baton Rouge, La.	1,200	4,397	7,501	12,034	26,586	45,535
New Orleans, La.	2,133	12,723	19,796	35,125	56,672	123,674
Lake Charles, La.	636	1,093	4,244	13,884	17,433	17,676

REGIONAL ECONOMY

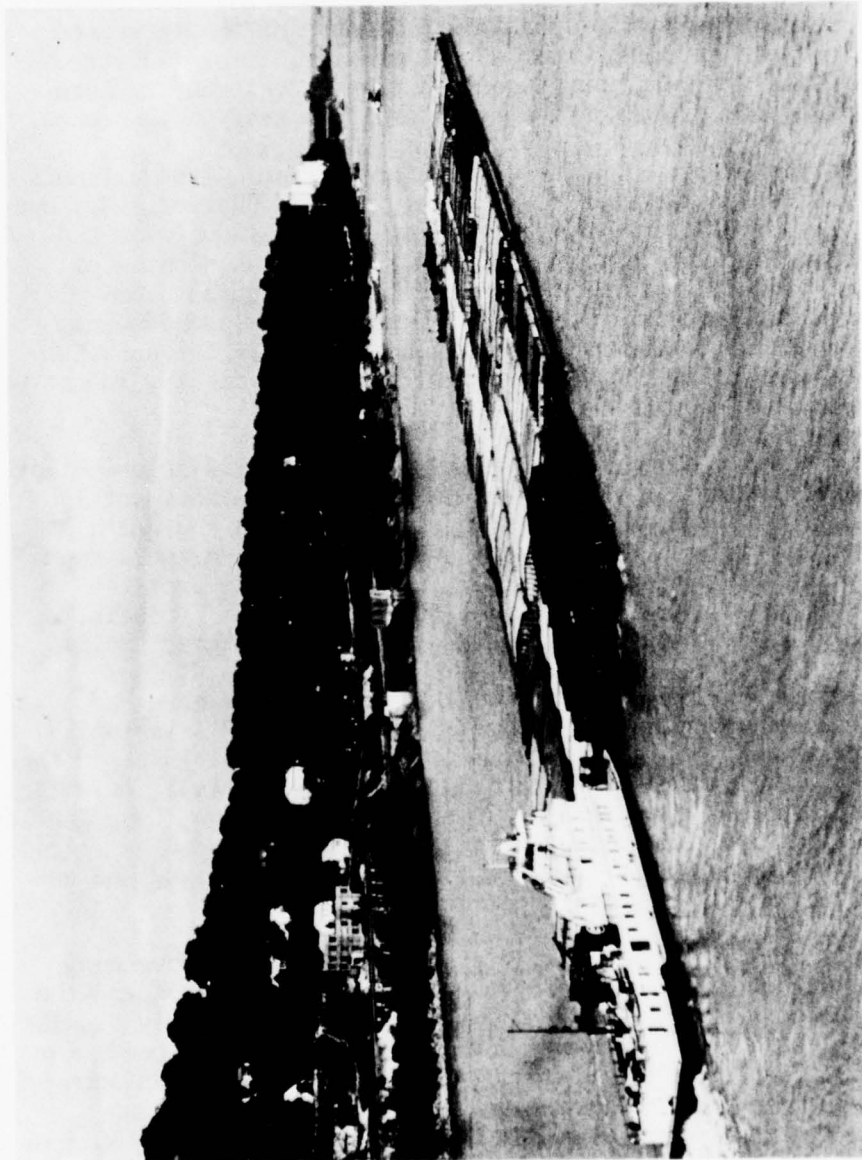
The Lower Mississippi region has experienced, along with the improvement of its waterways and modernization of waterway transportation equipment, an influx of industry along the banks of the Mississippi River and its tributaries. This has come about not only because of economical and dependable barge transportation but also because of the increased need for large amounts of fresh water as a raw material for industry. Large tracts of land are being purchased and plants constructed where such agricultural crops as cotton and sugarcane once grew in abundance.

Industry in the region is quite diversified. From Cairo, Illinois, to the Gulf of Mexico and between New Orleans and Lake Charles, La., one might see petroleum refineries and related facilities, industrial and agricultural chemical plants, grain elevators, processing plants for food and kindred products, shipyards, textile mills, manufacturers of paper and related products, power plants, cement plants, and aluminum complexes. In addition to the above industries, the Gulf Intracoastal Waterway and its connecting channels support a sizeable fishing industry and sulphur and salt mining.

The major commodities (in volume) moving over the Mississippi River to and from industries within the region, as well as to plants outside the area, include petroleum and petroleum products, grain and grain products, coal, sand and gravel, iron and steel products, miscellaneous ores, and paper and paper products. Major products moving over the Gulf Intracoastal Waterway include petroleum and petroleum products, industrial chemicals, nonmetallic minerals, and unmanufactured shells.

The Mississippi and Ohio Rivers and their tributaries have had a tremendous influence on the economic growth of the Lower Mississippi region in the past and will continue to provide substantial input in the future. Current and proposed expansion of harbor and terminal facilities at ports such as Memphis, Greenville, Vicksburg, Baton Rouge, Lake Charles, and New Orleans are expected to meet most of the needs imposed by this growth. New waterways, such as the Arkansas and the authorized Red and Yazoo Rivers, will also help support the region's growth.

New concepts of intermodal water transportation are now becoming visible on our inland waters. These new Lash and Seabee barges and the small self-propelled mini ship, will combine with the constantly growing fleets of conventional barges and towboats to meet industry's needs for efficient low-cost water transportation. Giant supertankers can soon be expected to operate in the offshore waters of the region. Growing demand by local interests along the coast for a superport in the Gulf of Mexico is being felt since the nation's fuel needs have been projected to exceed the domestic oil reserves in the near future. Recent studies by the State of Louisiana and a group of oil companies have favored



Typical Mississippi River Tow

This southbound tow with 25 barges uses the latest devices to maintain speed and maneuverability. Typical of these units is the incorporation of Kort nozzles for maneuverability, and modern radar for all-weather operation.

locating a superport within the Lower Mississippi region's offshore area near the Mississippi River. Such a facility, could create the need for expansion of the region's petroleum industry, further stimulating the economy of the area.

EXISTING NAVIGATION IMPROVEMENT

President James Monroe signed the Act of 30 April 1824 that authorized the Corps of Engineers to undertake their first Civil Works program - the improvement of streams for navigation. Shortly thereafter, work began in the Lower Mississippi region. That work consisted of removing snags and obstructions from the Mississippi River. Since that time the Corps of Engineers has constructed nearly 20,000 miles of inland and intra-coastal waterways in the United States. The Lower Mississippi region has nearly 3000 miles of these actively used shallow-draft waterways, most of which provide a minimum depth of 9 feet. The Gulf Intracoastal Waterway provides a minimum of 12 feet. In addition to the shallow-draft waterways, the region provides nearly 500 miles of deep-draft channels, predominately 40-foot minimum channel depths. Table 3 shows the miles of actively maintained shallow- and deep-draft waterways by WRPA.

Table 3 - Regional Summary
Existing Waterway Improvement

WRPA	Waterway		Total (Miles)
	Shallow Draft (Miles)	Deep Draft (Miles)	
1	720	271 ^{1/}	991
2	328	0	328
3	0	0	0
4	189	0	189
5	351	0	351
6	0	0	0
7	0	0	0
8	273	0	273
9	705	100	805
10	400	81	481
Total	2,966	452	3,418

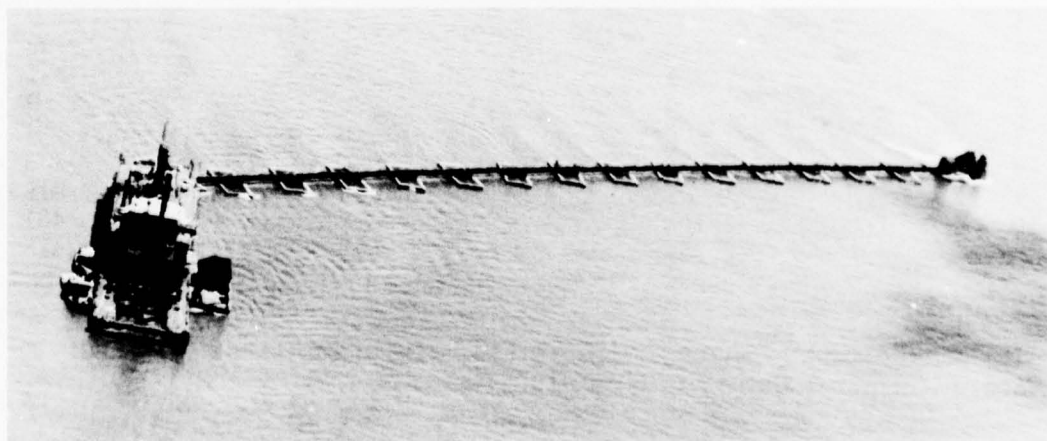
^{1/} Includes 22 and 15 miles, respectively, within Southwest Pass and South Pass, and their bar channels.

The rapid growth of waterborne commerce has been accompanied by the construction of many new ports and terminals, both public and private, as well as expansion of older ports along the rivers and waterways in the region. In 1970, New Orleans ranked as the second port for total waterborne commerce handled in the United States, while Baton Rouge was seventh, Lake Charles was twentieth, and Memphis ranked thirty-first. Further evidence of this growth can be seen by the growing number of public port authorities sanctioned by the states in the Lower Mississippi Region. Table 4 presents the 1970 listing of these authorities.

EXISTING & PROSPECTIVE COMMERCE

The total waterborne commerce moved over the waterways in the United States in 1970 amounted to 1,531.7 million tons, of which 581 million tons were listed as foreign commerce and 950.7 million tons were credited to domestic movements. The 1970 records for 9 selected ports in the Lower Mississippi Region reveal that over 13 percent of the U.S. total waterborne commerce was handled through these ports (203.8 million tons). Collectively, these 9 ports handled 8 percent of the foreign commerce and 16 percent of the U.S. domestic commerce (48.1 and 155.7 million tons, respectively). The existing and projected commerce for all ports in the region are shown by WRPA's for both Programs A and B in table 5. The port traffic is broken down into inland, coastwise, and foreign commerce.

A record total of 318.6 billion ton-miles of traffic moved over the inland waterways in 1970. The waterways in the Lower Mississippi Region accounted for 85.76 billion ton-miles or 26.3 percent of the U.S. total. The existing ton-miles carried by each WRPA are shown for both shallow- and deep-draft traffic, and for Programs A and B, in table 6.



Dredging in the Mississippi River.

Table 4 - Public Port Authorities Located in Study Area - 1970

<u>State of Louisiana</u>	
Abbeville Harbor and Terminal District	Abbeville, Louisiana
Avoyelles Parish Port Commission	Simmesport, Louisiana
Baton Rouge Port Commission	Port Allen, Louisiana
Caddo-Bossier Parishes Port Commission	Shreveport, Louisiana
Columbia Port Commission	Columbia, Louisiana
Concordia Port Commission	Vidalia, Louisiana
Delcambre Port Commission	Delcambre, Louisiana
East Cameron Port, Harbor and Terminal District	Cameron, Louisiana
Grant Parish Port Commission	Alexandria, Louisiana
Greater Plaquemines Parish Port Authority	Plaquemines Parish, Louisiana
Jefferson Port Commission	Harvey, Louisiana
Jonesville Port Commission	Jonesville, Louisiana
Krotz Springs Port Commission	Krotz Springs, Louisiana
Lafayette Harbor & Terminal District	Lafayette, Louisiana
Lafourche Port Commission	Galliano, Louisiana
Lake Charles Harbor and Terminal District	Lake Charles, Louisiana
Lake Providence Port Commission	Lake Providence, Louisiana
Livingston-Tangipahoa Parishes Port Commission	Albany, Louisiana
Madison Parish Port Commission	Tallulah, Louisiana
Morehouse Port, Harbor and Terminal District	Morehouse Parish, Louisiana
Morgan City Harbor and Terminal District	Berwick, Louisiana
New Iberia Port Commission	New Iberia, Louisiana
Pointe Coupee Port, Harbor and Terminal District	Morganza, Louisiana
Port of New Orleans	New Orleans, Louisiana
Rapides Parish Port Commission	Alexandria, Louisiana
Red River Navigation District	Natchitoches, Louisiana
St. Bernard Port, Harbor and Terminal District	Chalmette, Louisiana
St. Tammany Port Commission	Covington, Louisiana
South Louisiana Port Commission	Hahnville, Louisiana
Tensas Parish Port, Harbor and Terminal District	Tensas Parish, Louisiana
Terrebonne Port Commission	Houma, Louisiana
Union Parish Port, Harbor and Terminal District	Union Parish, Louisiana
Vinton Harbor and Terminal District	Vinton, Louisiana
West Calcasieu Port, Harbor and Terminal District	Sulphur, Louisiana
West Cameron Port, Harbor and Terminal District	Cameron Parish, Louisiana

Table 4 - Public Port Authorities Located in Study Area - 1970 (cont'd)

State of Mississippi

Claiborne County Port Commission	Port Gibson, Mississippi
Greenville Port Commission	Greenville, Mississippi
Natchez-Adams County Port Authority	Natchez, Mississippi
Warren County Port Commission	Vicksburg, Mississippi
Washington County Port Commission	Greenville, Mississippi
Vicksburg Port Commission	Vicksburg, Mississippi
Yazoo County Port Commission	Yazoo City, Mississippi

State of Missouri

None

State of Arkansas

Camden Port Authority	Camden, Arkansas
El Dorado Port Authority	El Dorado, Arkansas
Helena Port Authority	Helena, Arkansas
Pine Bluff-Jefferson County Port Authority	Pine Bluff, Arkansas
West Memphis Port & Harbor Commission	West Memphis, Arkansas

State of Kentucky

Hickman River Port Authority	Hickman, Kentucky
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State of Tennessee

Memphis and Shelby County Port Commission	Memphis, Tennessee
Memphis Riverfront Harbor Commission	Memphis, Tennessee

Table 5 - Regional Summary
Present and Prospective Commerce Port Traffic
(Thousand Short Tons)

WRPA	Traffic Category	1970	Program A			Program B		
			1980	2000	2020	1980	2000	2020
1 ^{1/}	Inland	0	0	0	0	0	0	0
2	Inland	6,507	8,609	15,881	29,734	9,274	18,263	34,961
3	Inland	10,321	12,197	23,708	45,007	14,776	29,239	55,172
4	Inland	5,922	9,508	22,539	37,262	12,062	26,068	43,948
4	Foreign	7	11	23	37	12	26	44
Subtotal WRPA 4		5,929	9,519	22,562	37,299	12,074	26,094	43,992
5	Inland	952	2,227	3,759	6,735	2,441	4,347	7,943
6	Inland	2,361	3,614	4,705	8,199	3,962	5,441	9,670
7	Inland	845	1,760	5,227	7,288	1,929	6,045	8,595
7	Foreign	2	4	14	19	5	16	22
Subtotal WRPA 7		847	1,764	5,241	7,307	1,934	6,061	8,617
8	Inland	22,013	30,243	55,540	109,490	33,323	70,027	149,314
8	Coastwise	9,549	12,723	21,032	38,468	14,236	26,751	52,708
8	Foreign	13,974	18,903	33,305	61,440	20,350	41,219	83,584
Subtotal WRPA 8		45,536	61,869	109,877	209,398	67,909	137,997	285,606
9	Inland	16,511	23,347	43,855	86,125	25,415	50,456	101,001
9	Coastwise	3,420	4,582	8,474	16,592	4,986	9,753	19,467
9	Foreign	1,893	2,664	4,927	9,647	2,899	5,670	11,318
Subtotal WRPA 9		21,824	30,593	57,256	112,364	33,300	65,879	131,786
10	Inland	60,052	79,188	130,770	231,894	86,276	157,717	303,841
10	Coastwise	31,407	40,752	64,812	112,101	45,686	80,005	150,995
10	Foreign	32,215	42,960	72,858	130,676	45,389	85,797	167,828
Subtotal WRPA 10		123,674	162,900	268,440	474,671	177,351	323,519	622,664
Total Inland		125,484	170,693	305,984	561,734	189,458	367,693	714,445
Total Coastwise		44,376	58,057	94,318	167,161	64,908	116,509	223,170
Total Foreign		48,091	64,542	111,127	201,819	68,655	132,728	262,796
Regional Total		217,951	293,292	511,429	930,714	323,021	616,840	1,200,411

^{1/} Data for Mississippi River ports are included in the adjacent WRPA's.

Table 6 - Regional Summary
Present and Prospective Commerce Waterway Traffic
(Thousand Ton-Miles)

WRPA	Traffic Category	1970	Program A		Program B	
			1980	2020	1980	2020
1	Shallow-draft	58,421,000	79,283,000	142,266,000	86,458,000	171,873,000
1	Ocean-going	12,556,000	16,729,000	28,236,000	18,163,000	34,452,000
	Subtotal WRPA 1	70,977,000	96,012,000	170,502,000	104,621,000	206,325,000
2	S-D	324,000	419,600	694,000	451,200	795,400
2	O-G	0	0	0	0	0
	Subtotal WRPA 2	324,000	419,600	694,000	451,200	795,400
3	S-D	0	0	0	0	0
3	O-G	0	0	0	0	0
	Subtotal WRPA 3	0	0	0	0	0
4	S-D	24,542	216,442	538,647	237,299	622,974
4	O-G	0	0	0	0	0
	Subtotal WRPA 4	24,542	216,442	538,647	237,299	622,974
5	S-D	80,688	209,924	379,231	229,704	437,743
5	O-G	0	0	0	0	0
	Subtotal WRPA 5	80,688	209,924	379,231	229,704	437,743
6	S-D	0	0	0	0	0
6	O-G	0	0	0	0	0
	Subtotal WRPA 6	0	0	0	0	0
7	S-D	0	0	0	0	0
7	O-G	0	0	0	0	0
	Subtotal WRPA 7	0	0	0	0	0

Table 6 - Regional Summary (cont'd)

Present and Prospective Commerce Waterway Traffic
(Thousand Ton-Miles)

WRPA	Traffic Category	Program A			Program B		
		1970	1980	2000	1980	2000	2020
8	S-D	1,013,995	1,516,315	3,085,754	1,624,254	3,456,626	7,540,203
8	O-G	0	0	0	0	0	0
Subtotal WRPA 8		1,013,995	1,516,315	3,085,754	1,624,254	3,456,626	7,540,203
9	S-D	8,485,651	12,538,207	23,433,122	13,425,898	28,530,725	54,425,277
9	O-G	172,162	236,443	438,684	257,436	504,994	2,474,478
Subtotal WRPA 9		8,657,813	12,574,650	23,871,806	13,683,334	29,034,719	56,899,755
10	S-D	2,773,786	3,917,468	7,099,932	4,146,755	7,844,307	15,343,086
10	O-G	172,678	331,690	608,881	360,262	732,259	1,517,599
Subtotal WRPA 10		2,946,464	4,249,158	7,708,813	4,507,017	8,576,566	16,860,685
Total Shallow-draft		71,123,662	97,900,956	177,496,686	106,573,110	213,560,775	434,806,128
Total Ocean-going		12,900,840	17,297,133	29,283,565	18,780,698	35,689,253	71,944,077
Regional Total		84,024,502	115,198,089	206,780,251	125,353,808	249,250,028	506,750,205

VESSELS & VESSEL TRAFFIC

Shallow Draft

Towboats and Tugs

The great variety of inland waterways in the study area is reflected in the fleet of towboats used. These boats range from small boats of a few hundred horsepower which are used within harbors and on the smaller streams, up to the larger towboats of nearly 10,000 horsepower used to move the huge barge fleets on the Mississippi River. These vessels range in size from around 35 feet long and 10 feet wide for the smallest up to about 185 feet long and 60 feet wide for the largest. Drafts generally don't exceed 8-9 feet for these inland towboats.

In contrast to the towboats, which are designed to operate only in inland waters, tugboats are versatile work horses which dock and undock ships in our ocean ports, and move barges and work rigs. Larger versions are used in deep sea towing jobs. These boats move their tows by pulling on hawsers, and, while they do move cargo barges, their major towing duties are in the field of equipment movements, such as dredges, darricks, oil rigs and the like. Tugboats represent a narrower range of sizes than do towboats. These are, generally, from 65 feet to 150 feet in length, 20 feet to 40 feet wide, with drafts of from 8 to 15 feet. Horsepower ranges from 350 for the smaller tugs to about 4500 for the largest.

Both types have evolved considerably in the areas of efficiency and safety over the last 30 years. Diesel power combined with more efficient propellers and transmissions have done much to keep the cost of barge transportation at low levels, while radios and radar have made safe all-weather service possible for an increasing number of the boats.

Barges

Barges used in the study area consist of three general types: bulk liquid, open hopper, and covered dry cargo. In addition, some shippers maintain fleets of highly specialized barges designed to carry their various products, such as acids, LNG, liquid sulphur, ammonia, and chlorine. Sizes vary greatly, however, the three sizes which predominate are the 35 feet X 195 feet X 9 feet barges and the large liquid cargo barges which are usually 50 feet X 250 feet X 9 feet or 50 feet X 290 feet X 9 feet. Cargo capacities for these 3 barges are about 1500 tons, 2200 tons and 3000 tons, respectively.

Other fairly common types of barges are deck barges, which are designed for carrying machinery and vehicles, railroad car floats, and derrick barges. The newest innovation in barges, and one which holds great promise, is the barge which is specially designed to be lifted fully loaded into an oceangoing mothership and transported overseas for



The M. V. Sarah Elizabeth

One of the modern diesel-powered vessels operating on the inland waterways, a towboat such as this will push 25-30 barges.

offloading at a foreign port from which point the barge and its cargo may then be moved by tow to its final destination, possibly at a river port. The two currently used systems are "Lash" and "Seabee." These two systems feature barges which are 61 feet 6 inches X 31 feet 2 inches X 12 feet and 95 feet X 35 feet X 12 feet, respectively.

Barge Tows

Barge tows vary greatly with respect to both numbers of barges and their configuration. The smaller natural streams and channelized waterways are suited to tows ranging generally from one to four barges in tandem, while the Mississippi River through tows may consist of as many as 50 barges. More efficient movement of such large multi-barge tows is made possible by the development of the integrated tow. These tows consist of many barges designed to be used as a unit. The lead barges have bows which are raked in the conventional manner, while the sterns are square. The remaining barges are square at both ends, thus, when lashed together, the combined underwater hull shape resembles that of a single large vessel. This eliminates the drag created by many water-breaking rakes in the middle of the tow.

Other Craft

In addition to the barge tow traffic, there are four other significant types of shallow-draft commercial vessels operating in the region. These are fishing boats, oil field crew boats and supply boats, and offshore construction and drilling vessels. These vessels are seen primarily in the WRPA's 8, 9, and 10 and in the southern reaches of WRPA 1, near the prolific oil and fish producing areas along the Gulf of Mexico.

Deep Draft

General

The study region contains three deepwater ports, the Ports of Baton Rouge, Lake Charles, and New Orleans, which by virtue of their approach depths, facilities, and annual cargoes, may be considered major world ports. Consequently, the range of vessel sizes and types calling in the region are representative of the world fleet, excluding, of course, the mammoth tankers which are not strictly port oriented.

General Cargo

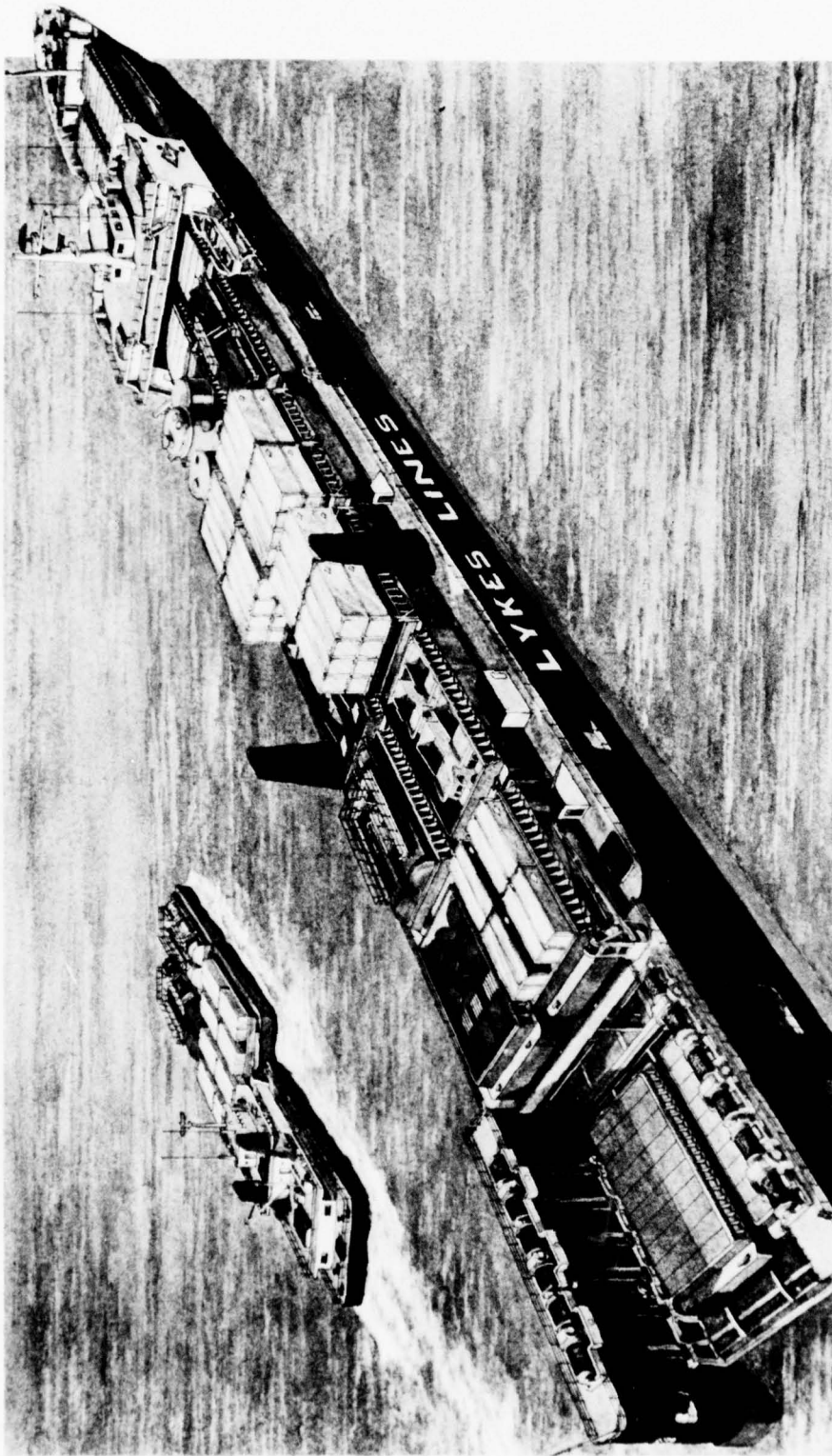
General cargo vessels calling at regional ports range from about 450 to 600 feet in length, with beams of from 60 to 85 feet. Loaded drafts vary from 25 to 35 feet, usually. These older, more traditional cargo liners, however, are being supplanted at an increasing rate by container ships and, to a lesser degree, by lighter carrying vessels such as the "Lash" and "Seabee."

Container ships vary in length from about 650 feet to 1000 feet, with beams ranging from 90 feet to 110 feet. Full load drafts may be up to



ACADIA FOREST

The first of the Lighter-Aboard-Ship vessels, or LASH, shown here at New Orleans. Such innovative concepts are typical of the rapidly changing world of ocean shipping.



SS DOCTOR LYKES

This lighter- aboard-ship vessel, commonly identified as a SEABEE, is another of the advanced fast cargo carriers.

43 feet. Respective dimensions for the "Lash" are 814 feet X 100 feet X 35 feet and for the "Seabee", 875 feet X 106 feet X 36 feet. Table 7 presents some of the principal characteristics of these vessels.

Table 7 - General Cargo Vessel Characteristics

<u>Deadweight tonnage</u>	<u>Length feet</u>	<u>Beam feet</u>	<u>Draft (Loaded) feet</u>	<u>Speed knots</u>
8,750 (General Cargo)	456	67	26.5	15.5
11,300 (General Cargo)	494	69	29.5	18.0
14,600 (General Cargo)	540	76	31.5	20.0
21,000 (General Cargo)	605	82	34.0	20.0
15,600 (Container)	669	90	33	23.0
19,300 (Container)	719	95	34	23.0
26,300 (Container)	819	105	37	26.0
48,500 (Container)	950	106	42.5	27.0
43,500 (Lash)	814	100	35	23.0
33,350 (SeaBee)	875	106	36	21.0

Bulk Carriers

Dry bulk carriers fairly representative of the world fleet call regularly at the many grain elevators and other bulk handling facilities in the Region, although some of the very largest are excluded due to draft limitations. Table 8 shows principal characteristics of bulk carriers using Regional ports.

Table 8 - Bulk Carrier Characteristics

<u>Deadweight tonnage</u>	<u>Length feet</u>	<u>Beam feet</u>	<u>Draft (Loaded) feet</u>	<u>Speed knots</u>
26,000	605	78	34	16.5
35,000	660	90	35.5	16.5
60,000	775	105	40.5	16.5
80,000	820	122	43.0	16.5
100,000	891	128	47.0	16.0
175,000	1,025	148	56.0	16.0

Tankers

The three major deepwater ports in the Region are also major centers



One of the first "super" ships, the Manhattan, shown here in grain service.

of chemical, petrochemical, and petroleum refining activity, thus, the fleet of tanker vessels calling at Regional ports is both large and varied as to size. The smallest are the obsolescent T-2 types which are being rapidly replaced by newer vessels, while the largest which has called is the 167,000 deadweight ton (DWT) bulk/oil carrier "Furness Bridge." Table 9 presents some typical vessels within this range and their characteristics.

Table 9 - Tanker Characteristics

<u>Deadweight tonnage</u>	<u>Length</u> feet	<u>Beam</u> feet	<u>Draft (Loaded)</u> feet	<u>Speed</u> knots
16,900	523	68	30.5	14.5
25,000	585	80	32.0	14.5
37,000	660	90	35.5	16.5
47,000	736	99	38.0	16.5
60,000	775	105	40.5	16.5
70,000	800	116	42.0	16.5
80,000	820	122	43.0	16.5
90,000	870	122	45.0	16.5
100,000	891	128	47.0	16.5
225,000	1,090	160	64.0	16.0

Future Developments

General

Shallow- and deep-draft shipping have seen rapid and dramatic developments in the last several years. This is expected to be true of the foreseeable future. While it is not possible to predict with exactness the detailed extent of such changes, the general direction of future trends can be outlined.

Shallow Draft

Shallow-draft transportation in the future will benefit increasingly from technological advances in the areas of safety, navigation and maneuvering aids, and construction techniques. Since, to a large extent, tow and barge sizes are a function of waterway dimensions, it is expected that size increases will be moderate, though major growth can be expected in absolute numbers of barges and in various types of specialized barges. One notable exception will be deep-draft oceangoing tug-barge combinations which will likely advance to sizes comparable to today's small and medium tankers.

The economies inherent in such intermodal techniques as "Lash" and "Seabee" will be reflected in vast fleets of barges designed to operate within such systems.

Deep Draft

Increasing world oceanborne trade will continue to provide impetus for major investment and advancement in the area of deep-draft shipping modes. Ships of all types will continue to increase in both size and numbers in the near term, slowing somewhat as the impact of such increased tonnage capacities is felt. Even as the maximum size moves toward stability, however, continued replacement of older, smaller ships by larger vessels will result in the average size continuing to increase.

General cargo. As in the recent past, general cargo carriers will continue to show rapid and dramatic changes. Heavier investment in special port facilities to support faster cargo handling and intermodal shipment methods will be widespread. In addition to the previously mentioned "Lash" and "Seabee" systems, other unitized-cargo movers will develop. One such currently existing type, the "Roll-on, Roll-off," will likely move to a strong position in certain specialized applications. Efficiencies inherent in such methods will ultimately result in the demise of much of the traditional break-bulk and "Tramp steamer" fleet, as obsolete ships are retired and replaced by unitized cargo movers. Other improvements and innovations in building techniques, propulsion methods, maneuvering aids and automated controls will continue to make the General Cargo field the most "technology intensive" in deep-draft shipping. Table 10 presents the projected composition of the future world fleet of general cargo vessels.

Table 10 - Distribution of Ship Sizes - General Cargo^{1/}

	<u>Year</u>			
	<u>1970</u> <u>DWT(1000)</u>	<u>1980</u> <u>DWT(1000)</u>	<u>2000</u> <u>DWT(1000)</u>	<u>2020</u> <u>DWT(1000)</u>
Largest General Cargo Vessel in World Fleet	25.72	33.69	50.00	50.00
Average General Cargo Vessel in World Fleet	8.09	8.59	9.70	10.00
Lower 25% of Ships	0- 4.67	0- 4.96	0- 5.61	0- 6.32
25-50% of Ships	4.67- 9.07	4.96- 9.46	5.61-10.88	6.32-12.27
50-70% of Ships	9.07-11.10	9.46-11.78	10.88-13.31	12.27-15.01
70-80% of Ships	11.10-11.93	11.78-12.67	13.31-14.31	15.01-16.14



Tug-Barge Under Way as a Single Unit

Combined tug-barge unit represents a totally new concept in coastwise transportation of bulk commodities. This unit offers a capacity of 285,500 bbls, combined with a standard speed of 14 knots laden, equivalent to a conventional tanker.

Table 10 - Distribution of Ship Sizes - General Cargo^{1/} (cont'd)

	<u>Year</u>			
	<u>1970</u> <u>DWT(1000)</u>	<u>1980</u> <u>DWT(1000)</u>	<u>2000</u> <u>DWT(1000)</u>	<u>2020</u> <u>DWT(1000)</u>
80-90% of Ships	11.93-12.85	12.67-13.64	14.31-15.41	16.14-17.38
90-95% of Ships	12.85-13.73	13.64-14.57	15.41-16.46	17.38-18.56
95-100% of Ships	13.73-24.72	14.57-25.72	16.46-50.00	18.56-50.00

Bulk carriers. Increasing world trade in grains, ores, and other dry bulk commodities will continue to spur the growth of bulk carriers. As shown in the following table, the upper size limit is expected to be about 400,000 DWT, with 50 percent of the 2020 fleet remaining in the relatively small, under 35,000 DWT class. Other changes to be seen in this class of vessels will be in the areas of automated ship control to reduce crew sizes and in shore side and shipboard loading-unloading equipment.

Table 11 - Distribution of Ship Sizes - Bulk Carriers^{1/}

	<u>Year</u>			
	<u>1970</u> <u>DWT(1000)</u>	<u>1980</u> <u>DWT(1000)</u>	<u>2000</u> <u>DWT(1000)</u>	<u>2020</u> <u>DWT(1000)</u>
Largest Bulk Carrier in World Fleet	170.00	224.00	400.00	400.00
Average Bulk Carrier in World Fleet	16.20	21.03	30.52	39.84
Lower 25% of Ships	0- 5.72	0- 7.41	0-10.76	0-14.04
25-50% of Ships	5.72-13.09	7.41-16.99	10.76-24.64	14.04-32.16
50-70% of Ships	13.09-20.37	16.99-26.43	24.64-38.36	32.16-50.08
70-80% of Ships	20.37-25.52	26.43-33.13	38.36-48.08	50.08-62.76

^{1/} Source: U.S. Department of Commerce, Maritime Administration (Projections published in Report of the Atlantic-Pacific Interoceanic Canal Study Commission dated 1 December 1970. Projections developed in 1968.)

Table 11 - Distribution of Ship Sizes - Bulk Carriers^{1/} (cont'd)

	Year			
	1970 DWT(1000)	1980 DWT(1000)	2000 DWT(1000)	2020 DWT(1000)
80-90% of Ships	25.52-33.36	33.13-43.30	48.08-62.84	62.76-82.04
90-95% of Ships	33.36-42.11	43.30-59.54	62.84-79.32	82.04-103.56
95-100% of Ships	42.11-170.0	59.54-224.0	79.32-400.0	103.56-400.0

Tankers. The world tanker fleet of the future is expected to develop into two general types; the large crude oil carriers of up to 1,000,000 DWT capacity, and a smaller class of petroleum product and other liquid product tankers. The border between the two classes of vessels will not be clearly drawn and there will be much interchange of purpose on either immediate side of it. The large crude carriers will, of necessity, operate between deepwater offshore terminals, with their cargoes moved to and from same via pipelines and/or smaller tankers, the drafts of which will allow them to call at conventional landside harbors.

Major technological advances will be seen in the area of automated ship controls, and safety and collision-avoidance systems in the largest ships. The table below presents projected composition of the world tanker fleet. It should be noted that by 2020, fully 50 percent of the fleet will be excluded by virtue of draft from most major ports in the U.S.

Table 12 - Distribution of Ship Sizes - Tankers^{1/}

	Year			
	1970 DWT(1000)	1980 DWT(1000)	2000 DWT(1000)	2020 DWT(1000)
Largest Tanker in World Fleet	326.00	762.00	1,000.00	1,000.00
Average Tanker in World Fleet	28.96	43.00	61.70	78.30

^{1/} Source: U.S. Department of Commerce, Maritime Administration (Projections published in Report of the Atlantic-Pacific Inter-oceanic Canal Study Commission dated 1 December 1970. Projections developed in 1968.)

Table 12 - Distribution of Ship Sizes - Tankers^{1/} (cont'd)

	<u>Year</u>			
	<u>1970</u> <u>DWT(1000)</u>	<u>1980</u> <u>DWT(1000)</u>	<u>2000</u> <u>DWT(1000)</u>	<u>2020</u> <u>DWT(1000)</u>
Lower 25% of Ships	0-15.39	0-22.86	0-32.8	0-41.6
25-50% of Ships	15.39-27.27	22.86-40.54	32.8-58.1	41.6-73.8
50-70% of Ships	27.27-36.94	40.54-54.86	58.1-78.7	73.8-99.8
70-80% of Ships	36.94-44.09	54.86-65.46	78.7-93.9	99.8-119.2
80-90% of Ships	44.09-56.88	65.46-84.43	93.9-121.2	119.2-153.8
90-95% of Ships	56.88-69.03	84.43-102.49	121.2-147.1	153.8-186.6
95-100% of Ships	69.03-326.0	102.49-762.0	147.1-1000.0	186.6-1000.0

FUTURE NEEDS

Long range navigation needs point to an eventual 12-foot inland waterway system for a large segment of the Mississippi and Ohio River Valleys to replace the standard 9-foot depth that, for the most part, now exists for shallow-draft traffic. This 12-foot depth now prevails on such waterways as the Gulf Intracoastal Waterway, some of its feeders, and the Atchafalaya River; is authorized for the Lower Mississippi River; and preliminary studies have been undertaken on the Upper Mississippi, Illinois, and Ohio Rivers. An inland waterway system with a 12-foot standard depth would permit greater economies of operation for existing shallow-draft craft and allow for new construction which could take full advantage of the greater channel depth.

The projected composition of ocean vessels of the world fleet, as previously shown in tables 10, 11, and 12, has created a need for enlargement of some deep-draft channels in the Lower Mississippi Region to depths greater than the existing 40 feet, if ports on these channels are to continue as important transshipping points for world trade. These larger channels will be needed primarily

^{1/} Source: U.S. Department of Commerce, Maritime Administration (Projections published in Report of the Atlantic-Pacific Interoceanic Canal Study Commission dated 1 December 1970. Projections developed in 1968.)



Mini-Ship Transitting Port of New Orleans

With an overall length of 215 feet, and operating draft of 9 to 16 feet, and a capacity of 3,000 tons of containerized and general cargo, this vessel is capable of operating to Tulsa, Oklahoma, or St. Louis, Missouri.

to accommodate the vessels that are projected to carry dry bulk cargo and refined liquid products. These categories are made up of commodities so varied in their make-up that a bulk loading facility in the Gulf would be impracticable on the grounds of economy and lack of harmonious operations among a great number of users. However, the growing need for imported crude petroleum in meeting the nation's energy demand will require a superport for the Gulf area to accommodate the supertankers that will be needed to satisfy this demand.

As can be seen above, satisfying the navigation needs in the region will involve more than merely insuring that the theoretical maximum capacity of the waterways will accommodate the commerce projected to move over them. The technological advances in the water transport will require channel enlargements long before the physical capacity of a waterway is reached, if the economies of scale for this mode of transportation are to be realized.

Table 13 presents the total navigation needs for the region (Programs A and B). The gross needs for the waterways are presented in ton-miles under the heading "New Channels" (deep and shallow draft). These gross needs are the ton-miles of waterborne commerce projected for the region as previously shown in table 6. The ton-mile figures shown in item "Existing Supply" reflect only the ability of the existing channels to carry the commerce as projected; the figures do not represent the maximum capacity of the waterways. This explains the changes in existing supply over time and also for the two projection programs. In expressing the needs for new deep-draft channels, the projections involve products of new industries, not now moving by water, that would move with the new channel in place. Consequently, the existing supply figures would not be affected by this added increment of projected commerce but would reflect only the ability of the existing waterways to carry the projected commerce moving over them.

As previously mentioned the future navigation needs in the United States, for the most part, must be satisfied through channel enlargement programs. These requirements for the Lower Mississippi Region are presented under the heading "Existing Facilities Improvement." The gross and net needs shown under this heading are the same (for both deep- and shallow-draft channels) and represent that portion of the total ton-mile projections (shown in the new channel-gross need category) that could benefit from channel enlargement work.

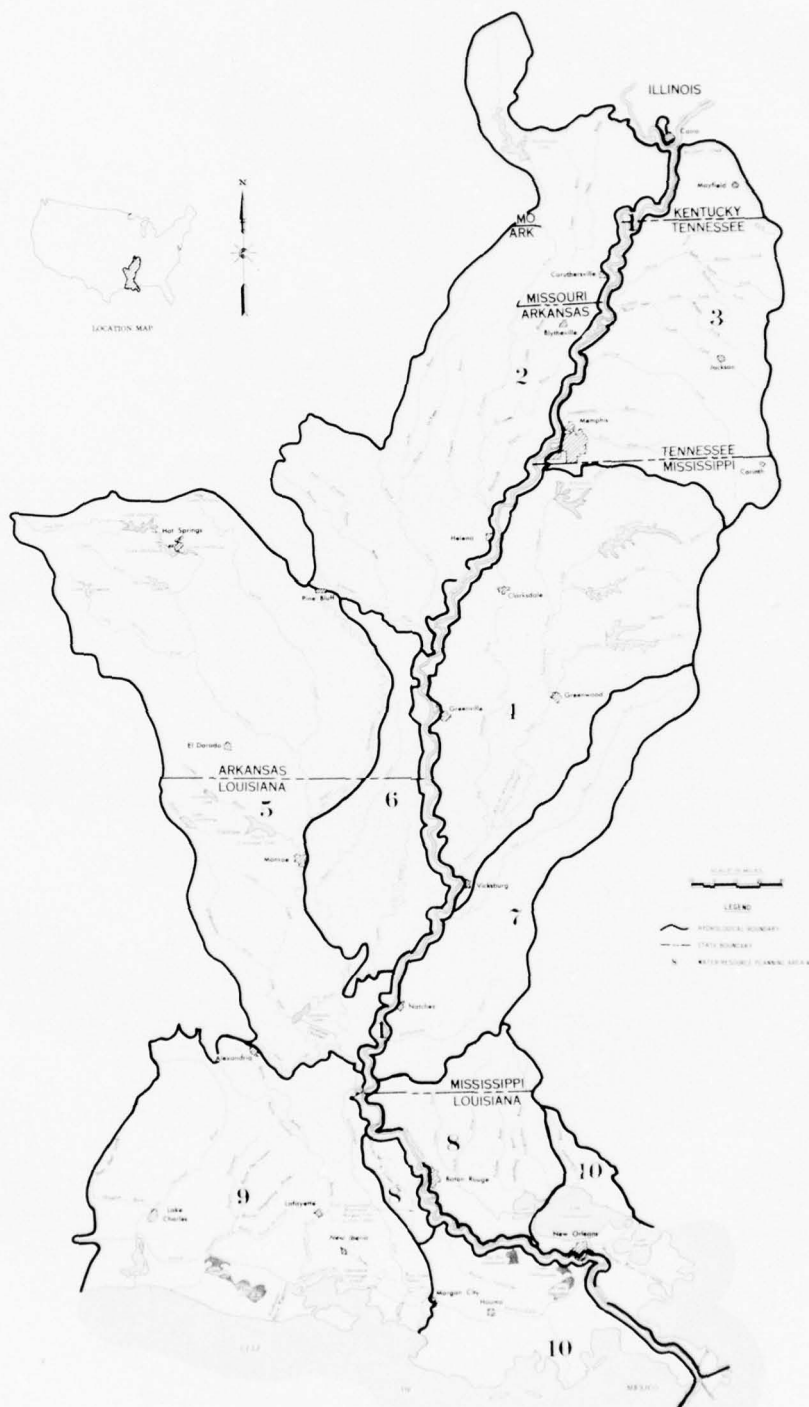
Navigation lock needs are expressed in "tons" for shallow-draft locks and in "number of lockages" for deep-draft locks. The net needs were determined by relating the projected demand for lockages to the results of recent lock capacity studies on the locks involved. Here, too, the existing supply indicates the ability of the existing locks in the system to accommodate the projected gross needs. Port and harbor needs are also shown in tons. The net needs were assumed to be equal to the total projected tonnage, less the estimated reasonable capacity of the existing facilities and available sites at the ports.

Table 13 - Regional Summary, Navigation Needs

Item	Program A			Program B		
	1970	1980	2000	1980	2000	2020
Deep-draft Channels (10 ⁶ Ton-Miles)						
New Channels						
Gross Needs	12,712	17,015	28,649	18,469	34,866	69,934
Existing Supply	12,712	17,015	28,649	18,469	34,866	68,469
Net Needs	0	0	0	0	0	1,465
Existing Facilities Improvement						
Gross Needs	0	15,531	26,607	17,180	32,268	62,589
Existing Supply	0	0	0	0	0	0
Net Needs	0	15,531	26,607	17,180	32,268	62,589
Shallow-draft Channels (10 ⁶ Ton-Miles)						
New Channels						
Gross Needs	71,313	98,183	178,132	106,884	214,384	436,816
Existing Supply	71,313	98,183	177,971	106,884	214,201	436,443
Net Need	0	0	161	0	183	373
Existing Facilities Improvement						
Gross Needs	50,321	68,499	150,446	74,619	181,045	365,653
Existing Supply	0	0	0	0	0	0
Net Need	50,321	68,499	150,446	74,619	181,045	365,653
Deep-draft Navigation Locks (# Ship Lockages)						
Gross Needs	242	777	960	777	960	1,140
Existing Supply	242	365	365	365	365	365
Net Need	0	412	595	412	595	775
Shallow-draft Navigation Locks (10 ⁶ Tons)						
Gross Needs	111	160	296	170	334	670
Existing Supply	111	157	190	160	190	190
Net Needs	0	3	106	10	144	480

Table 13 - Regional Summary, Navigation Needs (cont.)

<u>Item</u>	<u>Program A</u>			<u>Program B</u>		
	<u>1970</u>	<u>1980</u>	<u>2020</u>	<u>1980</u>	<u>2000</u>	<u>2020</u>
Deep-draft Harbors and Ports						
(10 ⁶ Tons)						
Gross Needs	92	122	205	134	249	486
Existing Supply	90	108	150	120	194	335
Net Needs	2	14	55	14	55	151
Shallow-draft Harbors and Ports						
(10 ⁶ Tons)						
Gross Needs	125	171	306	189	368	714
Existing Supply	125	162	261	175	310	585
Net Needs	0	9	45	14	58	129



LOWER MISSISSIPPI REGION
COMPREHENSIVE STUDY

STUDY AREA-MAJOR STREAMS AND NAVIGABLE WATERWAYS

FIGURE 1

W R P A 1

GENERAL DESCRIPTION

The Mississippi River, third longest in the world, flows from its headwaters in Lake Itasca, Minn., southward for 2340 miles to the Gulf of Mexico. Its drainage basin includes all or parts of 31 states and two Canadian provinces, totaling 1,245,000 square miles. This river provides an all-water route from the Gulf of Mexico to the Great Lakes and, together with its principal tributaries, the Ohio, Missouri, Illinois, Arkansas, and Tennessee Rivers, and the Gulf Intracoastal Waterway, comprises an inland navigation system without equal in the world.

WRPA 1 consists of the main stem of the Mississippi River below the mouth of the Ohio River between the main stem levees or to the top bank of the stream where levees do not exist. On the west bank, these levees begin just below Cape Girardeau, Missouri, and, except at tributary streams, extend uninterrupted to Venice, Louisiana, just above the Head of Passes. On the east bank levees extend intermittently from the vicinity of Hickman, Kentucky, to a point just above Vicksburg, Mississippi. Starting again at Baton Rouge, Louisiana, the east bank levee extends continuously to Bohemia, Louisiana, approximately 45 miles above the Head of Passes.

Agriculture, originally the only economically significant activity along the Mississippi River, is being increasingly supplanted by industrial facilities attracted to the river bank by the abundant supply of freshwater, mineral and other natural resources, and by the availability of inland and oceangoing transportation services. Areas where this trend is most readily observable include the Memphis Harbor and the entire reach of the river between Baton Rouge and New Orleans.



Head of Passes barely revealed at high water.

NAVIGATION IMPROVEMENTS

The present navigational status of the Mississippi River is the product of a gradual evolution which began with Congressionally authorized surveys as early as 1820. Various improvements were made subsequently in an attempt to facilitate navigation over specific short reaches and through the mouths of the river. The first truly significant improvement of a lasting nature, however, was the establishment in 1879 of a stable channel 30 feet deep through South Pass. Then in 1896, Congress authorized a navigation channel 9 feet deep and 250 feet wide at low water between Cairo, Illinois, and the Head of Passes. Subsequent authorizations and modifications have eventuated both in portions of WRPA 1 above Baton Rouge and below. Table 14 shows the existing navigation improvements.

Additionally, the Flood Control Act of 22 December 1944 authorized a 12-foot by 300-foot navigation project on the Mississippi River from Cairo, Illinois, to Baton Rouge, Louisiana. Work toward attainment of this 12-foot channel has not officially started pending outcome of studies for similar depth channels on upstream tributaries to the Mississippi River. However, 12-foot depths in the reach from Cairo to Baton Rouge are being achieved as a benefit of previously funded programs of bank stabilization and dredging.

The U.S. Coast Guard maintains all aids considered necessary for safe navigation on the Mississippi River and navigable tributary streams. Under recent legislation authority exists for the U.S. Coast Guard to establish and operate Vessel Traffic Systems (VTS), several of which are in the development stages for the Mississippi Region. Through the use of VHF radio, augmented by shore based radar coverage and low light level television observations, a vessel traffic center will be able to monitor, communicate with and advise or control all marine traffic within the area of designated system coverage. This technique has been used for several decades in busy European ports, and in concept is similar to the airport traffic controller whose function is to monitor and maintain safety among the aircraft operating within the congested traffic pattern of an airfield. The VTS covering the area from Gulf of Mexico entrance on the Mississippi River to Baton Rouge will begin in 1975. Other areas on the congested Intra-coastal waterways west of New Orleans are also scheduled for vessel traffic systems. In addition, traffic separation schemes employing the same concept as divided highways are encouraged whenever practicable for the added safety of navigation.

Table 14 - Existing Improvements, Mississippi River, Cairo, Ill.,
to the Gulf of Mexico, WRPA 1

<u>Reach</u>	<u>Depth</u> <u>feet</u>	<u>Width</u> <u>feet</u>	<u>Length</u> <u>miles</u>	<u>Remarks</u>
Mouth of Ohio River to Baton Rouge	9	300	720	Flood Control Act of 1944 authorized 12 foot depth in this reach.
Baton Rouge, La. to Port of New Orleans	40	500	128.6	
Through Port of New Orleans	35	1,500	17.2	
Through Port of New Orleans	40	500	17.2	R & H Act of 23 Oct 1962 authorized construction of this channel within the previously authorized 35 feet X 1500 feet channel.
Port of New Orleans to Head of Passes	40	1,000	86.7	
Head of Passes to Mile 20 B.H.P. ^{1/} via SW Pass	40	800	20	
SW Pass Bar Channel	40	600	2.0	
Head of Passes to Mile 13.5 B.H.P. ^{1/} via South Pass	30	450	13.5	
South Pass Bar Channel	30	600	1.5	

^{1/} B.H.P. Below Head of Passes

EXISTING COMMERCE

Table 15 presents the 1970 waterborne commerce for WRPA 1 in three reaches: Cairo, Illinois, to Baton Rouge, Louisiana; Baton Rouge to New Orleans, Louisiana; and New Orleans to the Head of Passes.

Inland Commerce

About 60 percent of inland tonnages moved in the WRPA 1 segment of the Mississippi River consist of grain, petroleum, and industrial chemicals. The grain tonnages represent downbound movements (primarily corn and soybeans) from the rich farm lands adjacent to the Upper Mississippi River System, destined for transfer to grain elevators in the Baton Rouge - New Orleans, Louisiana area. Nearly all of this grain is eventually exported.

The petroleum and chemical tonnages are principally comprised of refined petroleum products and basic chemicals originating at refineries and production plants below Baton Rouge, Louisiana, and on the GIWW west of New Orleans, Louisiana.

Other large movements include downbound coal, which is both shipped coastwise from New Orleans and to inland points on the GIWW, and, under the category of "Other," upbound shipments of salt, molasses, and sugar.

Oceangoing Commerce

Virtually all oceangoing tonnages shown for WRPA 1 consist of foreign and coastwise shipments handled within the Ports of New Orleans and Baton Rouge, Louisiana, and are discussed in the sections devoted to those two ports, WRPA's 8 and 10.

VESSEL COMPOSITION

Table 16 summarizes commercial vessel movements over WRPA 1. Descriptions of typical vessels and tow composition are contained in the Regional Summary.

Table 15 - 1970 Waterborne Commerce, WRPA 1 (Mississippi River)

Reach	Grain	Coal	Petroleum	CSSA ^{1/}	Inland					Other	Misc.	Total
					Sulphur	Steel	Iron & Industrial Chemicals	Agricultural Chemicals	Aluminum Ores			
Mouth of Ohio River to Baton Rouge, La.	18,338	7,117	21,773	3,895	562	5,734	8,707	3,178	907	5,606	9,741	85,558
Baton Rouge to New Orleans, La.	17,019	5,490	30,050	1,501	1,339	5,331	9,455	3,684	907	5,546	6,918	87,240
New Orleans, La. to Mouth of Passes	6,165	5,076	29,621	3,714	2,094	3,817	2,595	2,181	694	3,495	4,325	63,777
Oceangoing												
					Short Tons (1000)							
Mouth of Ohio River to Baton Rouge, La.	45	0	0	0	0	25	0	219	0	0	35	324
Baton Rouge to N.O., La.	15,002	304	12,977	0	0	1,829	2,421	2,693	6,603	1,086	3,515	44,430
N.O., La. to Mouth of Passes	20,622	4,387	35,065	114	2,349	5,132	3,278	4,367	7,256	2,980	8,250	93,800

^{1/} CSSA - Cement, stone, sand, and aggregate.

Table 16 - Vessel Trips, 1970, WPPA 1

Reach	Upbound					Downbound						
	Self-Propelled Vessels		Non-Self-Propelled Vessels		Total	Self-Propelled Vessels		Non-Self-Propelled Vessels		Total		
	Passenger & Dry Cargo	Tanker	Tugboat or Towboat	Dry Cargo		Tanker	Passenger & Dry Cargo	Tugboat or Towboat	Dry Cargo		Tanker	
Shallow Draft												
Mouth of Ohio River to Baton Rouge, La.	68	1	13,969	41,483	13,483	68,697	63	1	13,961	41,150	13,472	68,647
Baton Rouge, La. to New Orleans, La.	403	252	9,156	27,570	19,332	56,713	185	40	9,163	27,754	19,328	56,470
New Orleans, La. to Mouth of Passes	12,085	388	18,042	24,027	18,680	73,722	11,544	80	18,032	24,020	18,641	72,317
Passes of the Miss. ^{1/} River	5,182	367	1,636	640	1,044	8,869	4,636	73	1,633	644	1,006	7,992
Deep Draft												
Baton Rouge, La. to New Orleans, La.	508	383	0	5	0	869	392	141	0	9	1	543
19ft-24ft Draft	326	199	0	94	0	529	345	263	0	1	0	607
25ft-30ft Draft	148	86	0	0	0	234	394	362	0	0	13	769
31ft-36ft Draft	114	0	0	0	0	114	98	119	0	0	0	217
37ft-40ft Draft	1,006	668	0	99	0	1,773	1,227	885	0	10	14	2,136
Total	2,378	980	0	27	0	3,385	2,080	226	0	71	19	2,396
New Orleans, La. to Mouth of Passes	995	297	0	128	0	1,380	1,389	367	0	98	1	1,855
19ft-24ft Draft	313	165	0	3	0	481	691	781	0	0	13	1,485
25ft-30ft Draft	124	4	0	0	0	128	160	384	0	0	0	544
31ft-36ft Draft	3,770	1,446	0	158	0	5,374	4,320	1,758	0	169	33	6,280
37ft-40ft Draft												
Total												

^{1/} Included under "New Orleans, La. to Mouth of Passes"

Table 16 - Vessel Trips, 1970, WSPA 1 (cont'd)

Reach	Upbound				Downbound							
	Self-Propelled Vessels		Non-Self-Propelled Vessels		Self-Propelled Vessels		Non-Self-Propelled Vessels		Self-Propelled Vessels		Non-Self-Propelled Vessels	
	Passenger & Dry Cargo	Tugboat or Towboat	Dry Cargo	Tanker	Total	Passenger & Dry Cargo	Tugboat or Towboat	Dry Cargo	Tanker	Tugboat or Towboat	Dry Cargo	Tanker
Passes of the Mississippi River												
19ft-24ft Draft	2,357	980	0	28	0	3,365	2,062	228	72	3	19	2,384
25ft-30ft Draft	940	272	0	127	0	1,339	1,372	352	91	3	1	1,819
31ft-36ft Draft	309	159	0	0	0	468	686	850	0	0	13	1,549
37ft-40ft Draft	124	4	0	0	0	128	160	304	0	0	0	464
Total	3,730	1,415	0	155	0	4,280	4,280	1,734	163	6	33	6,216

Deep Draft

FUTURE NEEDS

Prospective Commerce

Waterborne Commerce in the selected commodity categories was projected in accordance with indices of output developed for the appropriate major industry groups. These indices are shown on table 17. In general, the Program A indices represent OBERS' forecast of economic growth for individual WRPA's within the Lower Mississippi Region. Program B indices were developed to reflect a regional growth in employment equal to the national average of 1.4 percent^{1/}. Application of these indices to the base year tonnages shown previously on table 15 yield future levels of commerce as shown in aggregate on table 18. These levels are designated as the gross needs of the area. Note that the projections are expressed in ton-miles.

Economic parameters for the industrial and agricultural activities which are situated between the levees in WRPA 1 have, for the purposes of this study, been included in the adjoining WRPA's.

Net Needs

Table 19 summarizes the net navigation needs projected to arise in WRPA 1 during the study period.

Shallow-Draft Channels

There is a need for improvement (deepening) of the existing channel between Baton Rouge, Louisiana, and Cairo, Illinois. This improvement is required to satisfy current and projected shallow-draft traffic demands.

Deep-Draft Channels

Under both Program A and B objectives, a need for improvement of the deep-draft route from Baton Rouge, Louisiana, to the Gulf of Mexico will arise by 1980. Deepening of the route from Baton Rouge to New Orleans will be required within the existing river channel, while improvement of the reach from New Orleans to the Gulf could be accomplished by deepening either the river channel or the MR-GO.

In addition, a study is currently authorized in response to a Senate resolution adopted on 19 June 1972, which directs the Corps of Engineers to study the feasibility of a channel deeper than 12 feet from Cairo to Baton Rouge.

^{1/} Further discussion of these indices and their derivations can be found in Appendix B, Economics.

Table 17 - Economic Forecast, WRPA 1
Indices of Productivity by Major Industries

Commodity (Industry Group)	Program	1967	1968	1970	1980	2000	2020
Grain (Agriculture)	A	--	--	100	127	173	237
	B	--	--	100	127	173	237
Coal (Mining, National)	A	100	104	110	137	223	329
	B	100	106	117	173	248	438
Petroleum (Average, Mining & Refining)	A	100	116	123	160	243	408
	B	100	118	130	189	323	582
CSSA (Quarrying)	A	100	100	108	148	270	504
	B	100	102	112	163	315	604
Sulphur (Quarrying)	A	--	--	100	100	100	100
	B	--	--	100	100	100	100
Iron, Steel & Aluminum (Primary Metals)	A	100	103	109	141	218	340
	B	100	112	122	171	311	540
Industrial Chemicals (Chemicals & Allied Products)	A	100	114	129	202	500	1,199
	B	100	114	135	239	696	1,792
Other Commodities (Chemicals & Allied Products)	A	100	114	129	202	500	1,199
	B	100	114	135	239	696	1,792
Miscellaneous Commod- ities (Other Manu- facturing)	A	100	105	116	169	364	782
	B	100	109	123	194	486	1,126

Table 18 - Present and Prospective Commerce, WSPA 1
(Ton-Miles x 10⁶)

Reach	1970 Commerce	Program A		Program B	
		1980	2000	1980	2000
		<u>Shallow Draft</u>			
Mouth of Ohio R. to Baton Rouge, La.	49,808	67,645	121,647	73,689	146,474
Baton Rouge to New Orleans, La.	6,700	9,089	16,254	9,959	20,035
New Orleans, La. to Gulf of Mexico	1,913	2,549	4,365	2,810	5,364
TOTAL	58,421	79,283	142,266	86,458	171,873
		<u>Oceangoing</u>			
Mouth of Ohio R. to Baton Rouge, La. ^{1/}	189	282	635	312	823
Baton Rouge, La. to New Orleans, La.	2,994	4,011	6,782	4,325	8,272
New Orleans, La. to Gulf of Mexico	9,373	12,436	20,819	13,357	25,357
TOTAL	12,556	16,729	28,236	18,163	34,452
			51,092		67,952

^{1/} Shallow-draft ocean commerce

Table 19 - Navigation Needs, WRPA 1

Item	1970	Program A		Program B	
		1980	2020	1980	2020
Deep-draft Channels (10 ⁶ Ton-Miles)					
New Channels					
Gross Need					
Existing Supply					
Net Need				NONE	
Existing Facilities Improvement					
Gross Need	0	15,440	26,051	17,089	31,646
Existing Supply	0	0	0	0	0
Net Need	0	15,440	26,051	17,089	31,646
Shallow-draft Channels (10 ⁶ Ton-Miles)					
New Channels					
Gross Need					
Existing Supply					
Net Need				NONE	
Existing Facilities Improvement					
Gross Need	49,997	67,927	122,282	74,002	147,297
Existing Supply	0	0	0	0	0
Net Need	49,997	67,927	122,282	74,002	147,297
Deep-draft Navigations Locks (# Ship Lockages)					
Gross Need					
Existing Supply					
Net Need				NONE	
Shallow-draft Navigation Locks (10 ⁶ Tons)					
Gross Need					
Existing Supply					
Net Need				NONE	

Table 19 - Navigation Needs, WRPA 1 (cont.)

Item	1970	Program A		Program B	
		1980	2020	1980	2020
Deep-draft Harbors and Ports (10 ⁶ Tons)					
Gross Need	2.3	13.8	151.2	13.8	151.2
Existing Supply	0	0	0	0	0
Net Need	2.3	13.8	151.2	13.8	151.2
Shallow-draft Harbors and Ports (10 ⁶ Tons)					
Gross Need					
Existing Supply					
Net Need					

NONE

NONE

Local shippers and others in areas adjacent to WRPA 1 have expressed continued interest in deep-draft navigation above Baton Rouge. To the extent that such navigation could be provided without locks and dams, future developments in marine transportation may warrant more detailed studies at some later date.

Locks

There are no lock needs projected to arise in WRPA 1 during the study period. Unlike the Upper Mississippi River where dams and locks are essential to maintain constant minimum water depths for navigation, the Lower Mississippi River is an open river where authorized depths can be maintained when necessary by dredging and training works.

Harbors and Ports

In addition to the other navigation needs in WRPA 1, a need exists for an offshore deepwater port (superport) to handle crude oil imports within the Gulf coast area of the Lower Mississippi Region. This need, expressed in tons, is shown below in table 20.

Table 20 - Crude Oil Imports, Net Needs, WRPA 1

<u>Year</u>	<u>Tonnage</u>
1970	2,280,000
1980	13,832,000
2000	55,360,000
2020	151,164,000

W R P A 2

GENERAL DESCRIPTION

Water Resources Planning Area 2 is located in southeastern Missouri and northeastern Arkansas and is comprised of 25 counties covering 16,723 square miles. The only navigable streams in this area are the White and Arkansas Rivers. The White River rises in northwest Arkansas, flows in a general northerly direction into Missouri, then 100 miles easterly through southeastern Missouri, recrosses into Arkansas, and flowing in a general easterly direction enters the Mississippi River 70 miles below Helena, Arkansas. The lower 74 miles are in WRPA 2.

The Arkansas River is the southern border of WRPA 2. The Arkansas River Waterway begins at the Mississippi River and the mouth of the White River, then 10 miles upstream in the White River to the mouth of Wild Goose Bayou, then 9 miles by canal to Arkansas Post on the Arkansas River, then upstream 65 miles to Pine Bluff, Arkansas, at lock and dam No. 4 where it leaves WRPA 2. At one time, the St. Francis and L'Anguille Rivers were navigable streams, however, maintenance of these channels for navigation ceased in 1942. Access to the St. Francis River above approximate mile 15 from the inland waterways system has been severed by flood control improvements. WRPA 2 is served by inland harbors on the Mississippi River at New Madrid and Caruthersville, Missouri, and Blytheville, Osceola, and Helena, Arkansas.

Of a total area of 27,765 square miles drained by the White River, 7,000 square miles are in the alluvial valley of the Mississippi River. The alluvial valley portion of the White River basin is, in general, a gently undulating plain 150 feet above mean sea level at the southern extremity and rises to the north and northwest at about two-thirds of a foot per mile.

In this area the mean annual temperature is 61° with killing frosts usually occurring between November and April. Average annual rainfall is 48 inches with yearly extremes of 23 and 70 inches. High river stages may usually be expected during January to May.

Existing Economic Development

This economic planning area is composed of nine counties in southeastern Missouri and 16 counties in northeastern Arkansas. The counties in Missouri are: Iron, Madison, Wayne, Scott, Stoddard, Mississippi, New Madrid, Dunklin and Pemiscott. The counties in Arkansas are: Clay, Greene, Mississippi, Craighead, Jackson, Poinsett, White, Woodruff, Cross, St. Francis, Lonoke, Prairie, Monroe, Lee, Arkansas and Phillips. The

population in 1970 was 626,690. The economy of WRPA 2 is based primarily on agriculture. In 1968, 29 percent of the total agricultural earnings on the Lower Mississippi Region were attributed to this area. Water resource development has played an important role in enhancing the agricultural potential of this WRPA. Sixty percent of the population is classified as rural, and the largest city has a population under 30,000. Industrial development is centered in Missouri cities of Charleston (1970 population - 5,131), New Madrid (27,050), Sikeston (14,699), and Caruthersville (7,350), and the Arkansas cities of Jonesboro (27,050), Blytheville (24,752), Forrest City (12,521), Paragould (10,639), Stuttgart (10,477), Helena (10,415), and Marianna (6,196).

The principal industries in WRPA 2 are agriculture, food and kindred products. Lumber and wood products industries are of major importance in this area. Shoe and apparel industries are also numerous in this WRPA.

Transportation Facilities (Excluding Waterways)

Rail Transportation

Because rail transportation rates are competitive with low water transportation rates in this area there is an inducement for industry to locate here. Presently four railway lines are operating with excellent coverage in this area. The area is served by the Missouri-Pacific, St. Louis-San Francisco, St. Louis-Southwestern, and the Chicago-Rock Island and Pacific Railways.

Highways

Major U.S. Highways are Interstate 55 north, Interstate 40 west, U.S. 62 and 64 west, U.S. 63 and 67 north and U.S. 60 west. A network of state and county roads provides access to all agricultural areas.

Airlines

Scheduled airline services are available at the Jonesboro airport, and charter flights can be arranged to many of the towns in this area.

Pipelines

Natural gas lines cross WRPA 2 in all directions and originate in various locations. There are points in this area where barges are loaded from pipelines for water transportation of refined petroleum. There are also some facilities for unloading petroleum from barges for land transportation through pipelines.

EXISTING AND AUTHORIZED NAVIGATION IMPROVEMENTS

General

Table 21 presents a summary of existing navigation improvements. Detailed information can be found in Appendix D, Inventory of Facilities.

Table 21 - Existing Navigation Improvements, WRPA 2

<u>Waterways</u>	<u>Depth</u> feet	<u>Width</u> feet	<u>Length</u> miles	<u>Remarks</u>
Arkansas River	9	250 min.	74	
White River	5	125	199 ^{1/}	5 feet from Augusta to mouth, or 8 feet at a stage of 12 feet on the Clarendon gage
White River	4.5	100	55	4.5 feet from Newport to Augusta
<u>Ports</u>				
Helena	9	450	4.6	
New Madrid	9	150	1.8	
Osceola	9	250	1.2	
Pine Bluff	9	250	.5	

Shallow-Draft Channels

All of the present navigation channel improvements in WRPA 2 were Federally constructed. Original authorization for navigation on the White River provided for channel maintenance by snagging, dredging, and contraction work to provide a channel 4.5 feet deep by 100 feet wide between the mouth and Batesville, Arkansas, a distance of 300 miles, under the River and Harbor Act approved 13 July 1892. Maintenance was discontinued after Fiscal Year 1951 due to negligible traffic; dredging and snagging resumed in 1962 for the reach between Augusta to the mouth. The existing project was modified in 1968 under the authority of Section

^{1/} The lower 10 miles serve both the Arkansas and the White River projects.

197 of the 1960 River and Harbor Act, as amended, to provide a 125-foot wide channel with a minimum depth of 5 feet and a depth of 8 feet at a stage of 12 feet on the Clarendon gage. The increased dimensions are being maintained to Augusta, at Mile 199. Under the authority of the River and Harbor Act of 1892, resumption of maintenance of the existing project on the White River from Newport to Augusta, a distance of 55 miles, was approved in February 1970 for dimensions of 4.5 feet by 100 feet. Project maintenance was resumed in 1972.

The Arkansas River project began in the 1950's to construct navigation features of the McClellan-Kerr navigation system. Four locks and dams are completed in WRPA 2, they are: Norrell lock and dam located on the Arkansas Post Canal in Arkansas County at navigation mile 10.3; Lock and dam No. 2, the lock is located on the Arkansas Post Canal at navigation mile 13.3 and the dam is located on the Arkansas River 40.5 miles upstream from the mouth of the Arkansas River; Lock and dam No. 3 is located on the Arkansas River in Jefferson and Lonoke Counties at navigation mile 50.2; Lock and dam No. 4 is located on the Arkansas River in Jefferson County at navigation mile 66.0. Channel depth on the Arkansas River is maintained at 9 feet and a minimum channel width of 250 feet is provided for. On the Arkansas Post Canal, channel width is 300 feet.

A project for improvement of St. Francis River for navigation was authorized by the River and Harbor Acts of March 3, 1871, June 14, 1880, July 5, 1884, August 11, 1888, and June 13, 1902, the latter adding L'Anguille River to the improvement. The original project for L'Anguille River was adopted by the River and Harbor Act of June 18, 1878. The original project for Blackfish Bayou was authorized by the River and Harbor Act of June 25, 1910 (II. Doc. No. 73, 61st Cong., 1st Sess.).

The project provided for the removal of snags in St. Francis River from its mouth to Marked Tree, in L'Anguille River from its mouth to Marianna, and in Blackfish Bayou from its mouth to Fifteen Mile Bayou, with the object of maintaining the channels clear of snags and similar obstructions at the lowest navigable stage.

Maintenance of these three channels ceased in 1942, at which time the commerce on the St. Francis River was 26,641 tons, while there was no commerce on L'Anguille River or Blackfish Bayou.

Deep-Draft Channels

There are no existing deep-draft channels within WRPA 2.

Locks

There are four locks in WRPA 2 and they are all located on the Arkansas River. There is also one lock located near Batesville, Arkansas, on the White River, however, it is not in WRPA 2. There is a lock on the St. Francis River at Marked Tree, Arkansas, which has been abandoned.

Shallow-Draft Ports

White River

There have been no Federal improvements at port facilities on the White River. Ports have been developed by local and private interests at major towns on the White River, including St. Charles, Clarendon, Des Arc, Augusta, DeValls Bluff, and Newport, all in Arkansas. Specific project dimensions have not been established, but ports are generally operated and maintained to provide interchange of commodities between water and land.

Mississippi River

New Madrid, Missouri. During the past several years, local interests have operated a port on the Mississippi River at New Madrid, Missouri. A Federal project at New Madrid Harbor was authorized by the Chief of Engineers in 1968 under Section 197 of the River and Harbor Act of 1960, as amended.

The project provides for dredging a channel 9 feet deep and 150 feet wide from the head of New Madrid Bar, about Mile 889 AHP, extending a length of about 9,400 feet. The project was completed in the summer of 1970. There are three existing terminals within the harbor area, and the harbor serves an industrial park area of approximately 200 acres.

Caruthersville, Missouri. Harbor facilities on the Mississippi River at Caruthersville, Missouri are operated by local interests and private enterprise. There have been no Federal improvements.

Blytheville, Arkansas. Local interests maintain a port on the Mississippi River at Blytheville, Arkansas. There have been no Federal projects at the Blytheville port.

Osceola, Arkansas. The existing port established by local interests at Osceola will be expanded by a Federal project authorized by the Chief of Engineers in 1971 under Section 107 of the River and Harbor Act of 1960, as amended.

The authorized plan provides for dredging a channel 9 feet deep and 250 feet wide for a length of approximately 6,500 feet. An industrial area of 97 acres will be served by the project channel.

Helena, Arkansas. A federal project for port development at Helena, Arkansas, was authorized by the Chief of Engineers in 1962 under Section 107, River and Harbor Act of 14 July 1960, as amended.

The project provides for maintenance of the access channel at a depth of 9 feet below low water, between Miles 659 and 663 AHP, by dredging and enlarging the upstream 0.6 mile to dimensions of 9 feet deep and approximately 450 feet wide. The project is complete. The harbor channel is approximately 3,000 feet in length, and the entire harbor, including 4 miles along the main river waterfront, serves an industrial port area of about 550 acres. There are 11 terminals within the harbor, two of which are publicly owned.

Deep-Draft Ports

There are no deep-draft ports within WRPA 2.

Navigation Aids

The U. S. Coast Guard maintains all necessary navigation aids on Federally constructed projects, and marks hazards to navigation.

EXISTING COMMERCE

Inland Commerce

A summary of existing waterborne commerce in WRPA 2 by commodity groups is presented in table 22.

White River

A total of 642,800 tons were moved on the White River in 1970. Major products moved were grains and CSSA, and major ports handled 645,900 tons. The CSSA products which moved on the river were handled through private terminals, and comparison of tonnage moved on the channel and through the ports indicates that some movements are from port to port within the channel of the White River.

Mississippi River Ports

Primary movements to and from WRPA 2 on the Mississippi River are CSSA, petroleum, and grain, and total tonnage was 5,176,600 tons in 1970.

Arkansas River

Total tonnage passing through WRPA 2 on the Arkansas River in 1970 was 3,418,520 tons. The port at Dumas, Arkansas, handles towboat refueling and has fuel gas and oil available. The port at Linwood, Arkansas handles agricultural products. The Pine Bluff, Arkansas harbor handles fleet servicing, sand, and agricultural products.

Coastwise Trade

There is no coastwise trade involving WRPA 2.

Foreign Trade

There is no foreign trade involving WRPA 2.



Snag removal on the White River, Arkansas.

Table 22 - 1970 Waterborne Commerce, WSPA 2

Waterway or Port	Grain	Petroleum	CSSA	Sulphur	Inland Tonnage Short Tons (1000)				Forestry	Other	General Cargo	Total
					Iron & Steel	Industrial Chemicals	Agricultural Chemicals					
Waterway: White River	362.7		250.2				0.8	29.1				642.8
Ports:												
White River	48.6									2.2		50.8
St. Charles, Ark.												
Clarendon, Ark.	56.0		51.4					29.0				136.4
Des Arc, Ark.	62.1											62.1
Augusta, Ark.	169.0						0.8	0.2				170.0
Devalls Bluff, Ark.	3.0											3.0
Newport, Ark.			196.6									196.6
Mississippi River												
New Madrid, Mo.	134.8	63.8	833.8	4.1				10.4	1.4			1048.3
Caruthersville, Mo.	146.3	99.0	512.0		4.5		5.2	22.3	175.8			965.1
Blytheville, Ark.	62.7					254.3	33.6	95.0	38.6	1.0		485.2
Osceola, Ark.	193.7	2.4	9.7					1.4	271.4			478.6
Helena, Ark.	300.6	1342.3	278.7	10.2	8.9	55.8	102.6	1.6	9.4			2110.1

Arkansas River

Total tonnage passing through WRPA 2 on the Arkansas River in 1970 was 3,418,520 tons. The port at Dumas, Arkansas, handles towboat refueling and has fuel gas and oil available. The port at Linwood, Arkansas handles agricultural products. The Pine Bluff, Arkansas harbor handles fleet servicing, sand, and agricultural products.

Coastwise Trade

There is no coastwise trade involving WRPA 2.

Foreign Trade

There is no foreign trade involving WRPA 2.



Snag removal on the White River, Arkansas.

Table 24 - Economic Forecast, WRPA 2
Index of Productivity by Major Industries

Commodity (Industry Group)	Program	1970	1980	2000	2020
Grain (Agricultural Production)	A	100	109	128	147
	B	100	109	138	157
Petroleum (Petroleum Refining)	A	100	150	319	620
	B	100	164	369	732
CSSA (Quarrying)	A	100	140	262	497
	B	100	154	303	586
Sulphur (Chemical Products)	A	100	98	253	615
	B	100	107	293	725
Iron and Steel (Pri- mary Metals)	A	100	140	278	513
	B	100	153	322	606
Industrial Chemicals (Chemical and Allied Products)	A	100	98	253	615
	B	100	107	293	725
Agricultural Chemicals (Agricultural Pro- duction)	A	100	109	128	147
	B	100	109	138	157
Wood and Paper (Forestry)	A	100	149	189	212
	B	100	186	264	360
Other (Chemical and Allied Products)	A	100	98	253	615
	B	100	107	293	725
General Cargo (Manu- facturing)	A	100	152	385	918
	B	100	166	466	1,083

FUTURE NEEDS

Prospective Commerce

General

Waterborne commerce in the selected commodity categories was projected in accordance with indices of output developed for the appropriate major industry groups. These indices are shown on table 24. In general, the Program A indices represent OBERS' forecast of economic growth for the individual WRPA's within the Lower Mississippi Region. Program B indices were developed to reflect a regional growth in employment equal to the national average, 1.4 percent^{1/}. Application of these indices to the base year tonnages shown previously on table 22 yield future levels of commerce as shown in aggregate on table 25. These levels are designated as the gross needs of the area. Note that the projections are expressed in ton-miles for the waterways and in short tons for the ports.

Projections of future needs for the Arkansas River were not developed, as the Arkansas River Navigation Project recently completed was planned and constructed to meet all needs for navigation on the Arkansas River within the foreseeable future.

Inland Traffic

Projected ton-miles for the White River are 419.6 million, 694.0 million, and 1195.2 million for the year 1980, 2000, and 2020, respectively. Future tons for major ports on the White River total 4.5 million, 6.3 million, and 9.1 million for 1980, 2000, and 2020, respectively. Projections for ports on the Mississippi River which serve WRPA 2 total 7.0 million tons, 13.6 million tons, and 26.5 million for the years 1980, 2000, and 2020, respectively.

Total Projected Commerce

Total projected tons for all ports and harbors in WRPA 2 indicate 8.6 million tons in 1980, 15.9 million tons in 2000, and 29.7 million in 2020. The average annual growth rate of program A for WRPA 2 is 3-1/8 percent.

Program B tons were derived as a multiple of Program A tons and factors developed in the Economic Appendix. They are 7.7 percent, 14.9 percent, and 17.5 percent greater than Program A in 1980, 2000, and 2020, respectively.

^{1/} Further discussion of these indices and their derivations is contained in Appendix B, Economics.

Table 25 - Present and Prospective Waterborne Commerce, WRPA 2
(Shallow Draft)

Waterway or Port	1970 Commerce	Program A		Program B	
		1980	2000	1980	2000
White River (Ton Miles 10 ⁶)					
	324.0	419.6	694.0	451.2	795.4
					1238.2
White River Ports (Tons 10³)					
St. Charles	139.9	152.5	179.0	152.5	193.0
Clarendon	369.3	402.6	472.7	402.6	509.7
Des Arc	93.1	101.4	119.1	101.4	128.4
Augusta	495.2	638.9	1007.1	693.1	1168.5
DeValls Bluff	3.0	3.3	3.8	3.3	4.1
Newport	234.1	294.8	455.2	307.3	512.2
Subtotal	1334.6	1593.5	2236.9	1660.2	2512.9
					3737.9
Mississippi River Ports (Tons 10 ³)					
New Madrid	1048.3	1433.3	2597.1	1563.5	2994.7
Caruthersville	965.1	1337.2	2582.8	1456.2	2983.3
Blytheville	485.2	535.1	1047.7	598.7	1246.4
Osceola	478.6	643.0	1328.7	683.2	1519.8
Helena	2195.4	3066.6	6087.6	3314.5	7002.7
Subtotal	5172.6	7015.2	13643.9	7614.1	15746.9
					31223.4
Total Port Tonnage	6507.2	8608.7	15880.8	9274.3	18262.8
					34961.3

Net Needs

General

Navigation needs data are shown in table 26 for Programs A and B. The tables include for various types of navigation improvement; gross needs for each time period, the needs satisfied by existing facilities at each time period, and the net needs that will require some type of navigation improvement to satisfy them.

Shallow-Draft Channels

The projected tonnage can physically be moved through the existing waterways. However, to move the projected tonnage more efficiently and economically, it will be necessary to improve existing channels to provide depths in WRPA 2 waterways comparable to those throughout the inland waterways system. Ton miles which would be benefited for Programs A and B are shown in table 26.

Deep-Draft Channels

There are no navigation needs presently estimated in WRPA 2 that will require construction of deep-draft channels.

Locks

It is not anticipated that there will be a need for improvement or replacement of the four locks located on the Arkansas River. Construction of locks may be considered as one alternative in developing needed shallow-draft channels.

Ports and Harbors

A need for port and harbor development exists in WRPA 2. Slackwater inland channels located off river mainstems are needed to provide areas for loading and unloading facilities and fleeting areas. The spoil from harbor construction will likely be used for industrial fills. The net needs are shown in table 26, and were assumed to equal to the total projected tonnage less the estimated tonnage which could be reasonably handled by the existing facilities. Net needs for Program A are estimated at 705,500 tons in 1980, 6,478,900 tons in 2000, and 20,293,000 tons in 2020. Net needs for Program B are estimated at 1,007,600 tons in 1980, 8,837,300 tons in 2000, and 25,510,500 tons in 2020.

Table 26 - Navigation Needs, WRP A 2

Item	Program A			Program B		
	1970	1980	2000	1980	2000	2020
Deep-draft Channels (10^6 Ton-Miles)						
New Channels						
Gross Need			NONE		NONE	
Existing Supply						
Net Need						
Existing Facilities Improvement						
Gross Need						
Existing Supply			NONE		NONE	
Net Need						
Shallow-draft Channels (10^6 Ton-Miles) ^{1/}						
New Channels						
Gross Need						
Existing Supply						
Net Need						
Existing Facilities Improvement						
Gross Need	324.0	419.6	694.0	451.2	795.4	1,238.2
Existing Supply	0	0	0	0	0	0
Net Need	324.0	419.6	694.0	451.2	795.4	1,238.2
Deep-draft Navigations Locks (# Ship Lockages)						
Gross Need			NONE		NONE	
Existing Supply						
Net Need						
Shallow-draft Navigation Locks (10^3 Tons)						
Gross Need						
Existing Supply			NONE		NONE	
Net Need						

^{1/} Ton-miles will depend on results of future navigation study.

Table 26 - Navigation Needs, WSPA 2 (cont.)

Item	1970	Program A		Program B	
		1980	2000	1980	2000
Deep-draft Harbors and Ports (10 ³ Tons)					
Gross Need					
Existing Supply			NONE		NONE
Net Need					
Shallow-draft Harbors and Ports (10 ³ Tons)					
Gross Need	6,507.2	8,608.7	15,880.8	9,274.3	18,262.8
Existing Supply	6,507.2	7,903.2	9,401.9	8,266.3	9,425.5
Net Need	0	705.5	6,478.9	1,007.6	8,837.3
					25,510.5

W R P A 3

GENERAL DESCRIPTION

Water Resources Planning Area 3 is located in southwestern Kentucky, western Tennessee, one county in eastern Arkansas and two counties in the northeastern corner of Mississippi. The area is drained by Mayfield and Obion Creeks in Kentucky, Obion, Forked Deer, Hatchie, Loosahatchie, and Wolf Rivers and Nonconnah Creek in Tennessee and Mississippi. This WRPA consists of four counties in southwestern Kentucky, 16 counties in western Tennessee, one in eastern Arkansas, two in northeastern Mississippi, and two in southern Illinois.

Areas adjacent to the Mississippi River are generally flat and covered with alluvial deposits. The rest of the area is covered with loess or windblown original soil and the topography is rolling. The elevation increases eastward from the Mississippi River, and in the higher elevations, lands have generally been cleared, while in the lower elevations, there are more woodlands.

In this area the mean annual temperature is 61° with killing frosts usually occurring between November and April. Average annual rainfall is 48 inches with yearly extremes of 23 and 70 inches. High river stages may usually be expected during January to May.

Existing Economic Development

WRPA 3 consists of 23 counties and is dominated by the economic structure of the Memphis Standard Metropolitan Statistical Area (SMSA) which functions as a well diversified manufacturing center and a major distribution center for wholesale and retail trade. The SMSA by definition includes Crittenden County, Arkansas, which is included in the WRPA. The counties in Kentucky are: Carlisle, Graves, Hickman, and Fulton. The counties in Tennessee are: Lake, Obion, Weakley, Dyer, Gibson, Carroll, Lauderdale, Crockett, Madison, Haywood, Tipton, Shelby, Fayette, Hardeman, McNairy, and Chester. The counties in Mississippi are Tippah and Alcorn.

The population in 1970 was 1,258,009. The economic structure of WRPA 3 is more diversified than any other WRPA in the Lower Mississippi Region. WRPA 3 contributed the largest share of gross product originating in manufacturing in 1968, and it contributed 27.5 percent of the total earnings generated by manufacturing in the region. Major manufacturing industries include apparel and other textiles, lumber and furniture,

paper and allied products and food and related material. In addition to manufacturing, wholesale and retail trade are important economic activities in the industrial structure.

Transportation Facilities (Excluding Waterways)

Railroads

The area is served by the Illinois Central-Gulf, Missouri-Pacific and Louisville and Nashville, Southern and St. Louis and San Francisco Railway. A network of rail facilities provides access to all areas within the WRPA.

Highways

Major U. S. Highways are Interstate 40, Interstate 55, U. S. Highway 51, 45, 72, 70, 79, and 78. A network of state and county roads provides access to all agricultural areas.

Airlines

Scheduled airline service for passenger and air freight is available to all parts of the United States at the Memphis International Airport. Charter flights can be arranged to many of the small towns throughout the subregion.

Pipelines

Natural gas lines cross WRPA 3 in all directions and originate in various locations. There are facilities in this area to load barges from pipelines for water transportation of refined petroleum. Also, there are some facilities for transferring petroleum from barges to pipelines for land transportation.

EXISTING AND AUTHORIZED NAVIGATION IMPROVEMENTS

General

Table 27 presents a summary of existing navigation improvements. Detailed information can be found in Appendix D, Inventory of Facilities.

Table 27 - Existing Navigation Improvements, WRPA 3

<u>Ports</u>	<u>Depth</u> feet	<u>Width</u> feet	<u>Length</u> miles	<u>Remarks</u>
Hickman Harbor	9	250	1.1	Turning basin 500 feet wide
Wolf River	9	*250 and 200	3	*250 feet from mouth to Keel Ave. 200 feet from Keel Ave. to mile 3.0
Memphis Harbor (Presidents Island)	12	300	9	

Shallow-Draft Channels

There are no active navigation channels in WRPA 3. In past years, however, there was some navigation on the Obion and Forked Deer Rivers of West Tennessee.

Obion River

The Obion River navigation project was based on a survey made in 1891, and was authorized in 1892. The project provided for a 3-foot navigation depth at low water by means of open-channel work. During the calendar year 1910, commerce on this stream amounted to 18,638 short tons, consisting almost wholly of timber products.

There is no commercial navigation on the Obion River and maintenance of the navigation project ceased many years ago.

Forked Deer River

A navigation project on Forked Deer was authorized by the River and Harbor Act of 2 August 1882 based on a report of an examination of the South Fork of the Forked Deer, dated 16 December 1880. The operations proposed were open-channel work, to maintain a satisfactory channel all year. The project was set aside because the desired result could not be accomplished by the proposed method. A later project based on the provisions of the Act of 3 March 1899 provides for maintenance of the channel for navigation by the removal of surface obstructions as necessary. The bulk of the commerce up to 1912 consisted of timber products. Currently there is no commerce on the stream and maintenance of navigation projects has ceased.



Memphis Harbor, Tennessee

The Mississippi River is in the background.

Deep-Draft Channels

There are no deep-draft channels within the WRPA 3.

Locks

There are no existing locks in WRPA 3.

Ports

Shallow Draft

WRPA 3 is served by four major port areas on the Mississippi River. They are located at Wickliffe and Hickman, Kentucky; Tiptonville and Memphis, Tennessee. The port at Memphis includes facilities at West Memphis, Arkansas; Wolf River Harbor and the Presidents Island Development, known as Memphis Harbor, Tennessee.

Wickliffe, Kentucky

A small port at Wickliffe, Kentucky, with equipment handling and storage facilities is operated by local interest. There have been no Federal improvements at this port.

Hickman, Kentucky

A Federal project at Hickman Harbor, Kentucky, was authorized by the Chief of Engineers in 1962 under Section 107, River and Harbor Act of 1960, as amended. The project is complete and maintained at project dimensions.

The project consists of dredging and maintaining a harbor channel 250 feet wide with a depth of 9 feet below low water, from the main channel of the Mississippi River at Mile 922 AHP. The harbor is about 6,000 feet in length with the upper 600 feet forming a turning basin 500 feet wide. The project serves existing terminal facilities for handling petroleum products, sand and gravel and grain. There is, in addition, about 0.2 mile of surfaced public mooring and launching area. Total waterfront industrial area served is approximately 130 acres.

Tiptonville, Tennessee

The port of Tiptonville is operated by local interests. There have been no Federal improvements at this port.

Memphis, Tennessee

Port facilities at West Memphis are on the main channel of the Mississippi River and are operated by private enterprise. The port in Wolf River, Tennessee, was authorized by the 1958 Flood Control Act (House Document No. 26/72/1 and 45/74/1).

The project provides a channel 9 feet deep at low water from the mouth to mile 3 (15,840 feet), with bottom widths of 250 feet from the mouth to Keel Avenue and 200 feet from Keel Avenue to mile 3.0. There are twenty terminals along the project channel which occupy approximately 130 industrial acres. One terminal is operated by the Coast Guard, two by contract carriers, and 17 are privately operated.

The Memphis Harbor (Presidents Island) project was authorized by the Flood Control Act of 24 July 1946. The project consists of off-river harbor channels 12 feet by 300 feet, totaling approximately 9 miles, a 960-acre industrial fill on Presidents Island, and protection from flooding for an area of 6,800 acres for industrial development.

There are 20 docks on the project channels, including two public terminals. Total commerce moved through the project in 1970 was 10,018,000 tons, and has been increasing annually.

Deep Draft

There are no deep-draft ports in WRPA 3.

Navigation Aids

The U. S. Coast Guard maintains all necessary aids to navigation on Federally constructed projects, and marks hazards to navigation.

Authorized Navigation Improvements

All authorized navigation improvements in WRPA 3 have been completed and are described above as existing projects.

EXISTING COMMERCE

General

Waterborne commerce handled through major ports in WRPA 3 amounted to 10,321,300 tons in 1970. Ninety-seven percent of this tonnage, 10,017,800 tons, were handled through the port at Memphis. Memphis is clearly the major distribution center for the WRPA 3 and entire mid-south area. Products handled at ports other than Memphis are primarily locally produced agricultural products, with a small amount of petroleum and timber products.

The port at Memphis handles a diversity of products. Historically the major commodities have been petroleum, grains, and coal.

In addition to its history as a major distribution center for bulk products, Memphis is becoming a center for processing and manufacturing, and movement of raw materials and manufactured products are becoming more important.



"Delta Queen"-a reminder of another era on the Mississippi.

Table 28 - 1970 Waterborne Commerce, WSPA 3
(Thousand Short Tons)

<u>Port</u>	<u>Grain</u>	<u>Coal</u>	<u>Petroleum</u>	<u>CSSA</u>	<u>Iron & Steel</u>	<u>Industrial Chemicals</u>	<u>Agricultural Chemicals</u>	<u>Forestry</u>	<u>Other</u>	<u>General Cargo</u>	<u>Total</u>
Wickliffe, Kentucky	6.5							3.8			10.1
Hickman, Kentucky	118.2		43.0					1.6			162.8
Tiptonville, Tennessee	130.6										130.6
Memphis, Tennessee ^{1/}	1,366.9	1,625.5	4,815.0	1,092.0	477.5	132.5	10.6	69.5	167.3	181.0	10,017.8

^{1/} Includes Wolf River, Tennessee.

FUTURE NEEDS

Prospective Commerce

General

Waterborne commerce in the selected commodity categories was projected in accordance with indices of output developed for the appropriate major industry groups. These indices are shown on table 29. In general, the Program A indices represent OBERS' forecast of economic growth for the individual WRPA's within the Lower Mississippi Region. Program B indices were developed to reflect a regional growth in employment equal to the national average, 1.4 percent^{1/}. Application of these indices to the base year tonnages shown previously on table 28 yield future levels of commerce as shown in aggregate on table 30. These levels are designated as the gross needs of the area. Note that the projections are expressed in ton-miles for the waterways and in short tons for the ports.

Total Projected Commerce

Total projected tons for all ports in WRPA 3 are 12.2 million in 1980, 23.7 million in 2000, and 45.0 million in 2020. The port at Memphis will continue to carry more than 97 percent of the projected tonnage.

The average annual growth rate of Program A for WRPA 3 is 3.0 percent. Program B tons were derived as a multiple of Program A tons and factors developed in the Economics Appendix. There are 21.1 percent, 23.3 percent, and 22.5 percent greater than Program A in 1980, 2000, and 2020, respectively.

Net Needs

General

Navigation needs data are shown in table 31 for Programs A and B. The tables include the gross needs for each time period, the needs to be satisfied by existing facilities at each time period, and the net needs that will require some type of navigation improvement to satisfy them. The various type navigation improvements are also shown.

Shallow- and Deep-Draft Channels

There are no navigation needs presently identified in WRPA 3 that would require shallow- or deep-draft channel type construction work.

^{1/} Further discussion of these indices and their derivations is contained in Appendix B, Economics.

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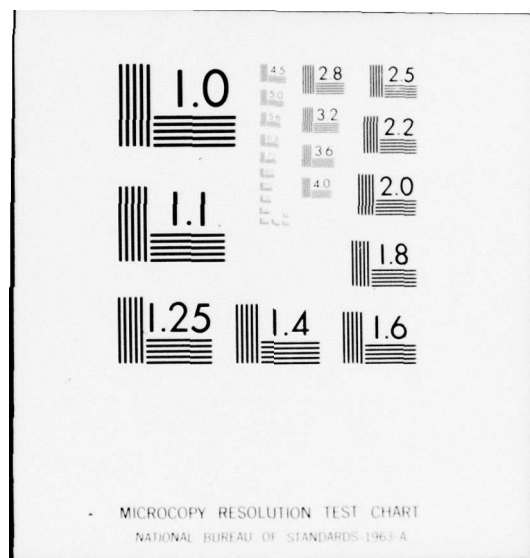


Table 29 - Economic Forecast, WRPA 3
Index of Productivity by Major Industries

Commodity (Industry Group)	Program	1970	1980	2000	2020
Grain (Agricultural Production)	A	100	116	138	163
	B	100	116	149	176
Petroleum (Petroleum Refining)	A	100	148	316	612
	B	100	162	366	722
CSSA (Quarrying)	A	100	141	250	459
	B	100	155	290	541
Sulphur (Chemicals and Allied Products)	A	100	189	523	1,331
	B	100	207	605	1,570
Iron and Steel (Pri- mary Metals)	A	100	136	270	520
	B	100	149	312	613
Industrial Chemicals (Chemicals and Allied Products)	A	100	189	523	1,331
	B	100	207	605	1,570
Agricultural Chemicals (Agricultural Pro- duction)	A	100	116	138	163
	B	100	116	149	176
Forestry (Forestry Products)	A	100	98	147	166
	B	100	122	196	335
Other (Chemicals and Allied Products)	A	100	189	523	1,331
	B	100	207	605	1,570
General Cargo (Manu- facturing)	A	100	153	377	855
	B	100	168	436	1,044

Table 30 - Present and Prospective Waterborne Commerce, WRPA 3
Shallow-Draft Ports
(Thousand Short Tons)

<u>Waterway or Port</u>	<u>1970 Commerce</u>	<u>Program A</u>		<u>Program B</u>	
		1980	2000	1980	2020
Wickliffe	10.1	11.6	14.3	12.0	23.9
Hickman	162.8	202.3	301.2	208.7	523.7
Tiptonville	130.6	151.1	180.3	151.1	229.9
Memphis	10,017.8	11,832.1	23,212.4	14,404.6	54,394.5
TOTAL	10,321.3	12,197.1	23,708.2	14,776.4	55,172.0

Locks

There are no existing navigation locks in WRPA 3, and therefore, no need for lock replacement or construction. Construction of locks may be considered as one alternative in providing constant level slackwater port developments off main river channels.

Ports and Harbors

There will be a need for port and harbor development in WRPA 3. Slackwater inland channels located off river mainstems are needed to provide areas for loading and unloading facilities and also fleeting areas. The spoil from any harbor construction may be used for industrial fill. The net needs are shown in table 31, and were assumed to be equal to the total projected tonnage less the estimated reasonable capacity of the existing facilities. Net needs for Program A for 1980, 2000, and 2020 are 332,100; 11,763,600; and 33,027,400 tons, respectively. For Program B, net needs for the same three periods are 2,904,600; 17,277,100; and 43,168,200.

Table 31 - Navigation Needs, WRP A 3

Item	Program A			Program B		
	1970	1980	2000	1980	2000	2020
Deep-draft Channels (10^6 Ton-Miles)						
New Channels						
Gross Need			NONE		NONE	
Existing Supply						
Net Need						
Existing Facilities Improvement						
Gross Need			NONE		NONE	
Existing Supply						
Net Need						
Shallow-draft Channels (10^6 Ton-Miles)						
New Channels						
Gross Need			NONE		NONE	
Existing Supply						
Net Need						
Existing Facilities Improvement						
Gross Need			NONE		NONE	
Existing Supply						
Net Need						
Deep-draft Navigations Locks (# Ship Lockages)						
Gross Need			NONE		NONE	
Existing Supply						
Net Need						
Shallow-draft Navigation Locks (10^3 Tons)						
Gross Need			NONE		NONE	
Existing Supply						
Net Need						

Table 31 - Navigation Needs, WRP 3 (cont.)

Item	Program A			Program B		
	1970	1980	2000	1980	2000	2020
Deep-draft Harbors and Ports (103 Tons)						
Gross Need						
Existing Supply						
Net Need			NONE		NONE	
Shallow-draft Harbors and Ports (103 Tons)						
Gross Need	10,321.3	12,197.1	23,708.2	14,776.4	29,238.6	55,172.0
Existing Supply	10,321.3	11,865.0	11,944.6	11,871.8	11,961.5	12,003.8
Net Need	0	332.1	11,763.6	2,904.6	17,277.1	43,168.2

W R P A 4

GENERAL DESCRIPTION

The Yazoo Water Resource Planning Area is in the northwest portion of the State of Mississippi. This area extends generally from the Chickasaw Bluffs south of Memphis, Tenn., to the Walnut Hills at Vicksburg, Miss., a distance of about 200 miles.

The Yazoo, Tallahatchie, and Coldwater Rivers form the main stem of the Yazoo Basin drainage system near the eastern boundary of the basin. In the western section of the basin, the Big Sunflower River and its tributaries (Quiver River, Hushpuckena River, Bogue Phalia, and Deer Creek) provide drainage. The area west of Deer Creek and east of the main-line Mississippi River levees is drained by Steele Bayou.

That portion of the Yazoo Basin above Yazoo City, Miss., is referred to as the Yazoo Headwater Area. The principal hill tributaries in the Headwater Area are the Little Tallahatchie, Yocona, Coldwater, and Yalobusha Rivers. The principal delta tributaries include Cassidy Bayou and Tchula Lake. The Headwater Area comprises an area of 8,900 square miles--one-fourth of which is in the alluvial valley and three-fourths of the area is in hill lands.

The Big Sunflower River's western border is the east bank main-line levee of the Mississippi River and is bordered on the east by the drainage areas of Cassidy Bayou, and the Tallahatchie and Yazoo Rivers. The length of the basin is about 140 miles in a north-south direction, with an average width of 30 miles. The basin extends from the vicinity of Clarksdale, Miss. (Hull Brake), to the confluence of Yazoo River and Steele Bayou--about 10 miles north of Vicksburg, Miss. The two major drainage outlets are Big Sunflower River and Steele Bayou.

The Yazoo WRPA experiences a generally mild climate. Warm, humid summers and moderate winters are characteristic of the area. Temperatures average about 63° F. annually. The average annual rainfall is 52 inches. A greater part of the precipitation occurs during the winter and spring--80 percent of the annual runoff occurs during this period. Freeze-free periods (growing season) average about 230 days for WRPA 4.

Existing Economic Development

In 1968, total employment in WRPA 4 was estimated at 231,000 persons--an increase of 9 percent over the number reported in 1959. Total earnings for the area in 1968 were approximately \$974 million.

Industries which made significant contributions to total earnings included agriculture, 27 percent of total and manufacturing, 21 percent. Manufacturing has become increasingly important to the area's economy. Principal manufacturing industries include: chemicals and allied products, food and kindred products, and textile mill products.

Valuable natural resources which have contributed to the existing economy include: fertile agricultural lands, forests, mineral deposits, and wildlife. Of the total area, 92 percent is in agricultural lands--which consists of 78 percent in farms, 20 percent in forest land, and 2 percent in other nonfarm lands. Non-agricultural lands account for 6 percent of the total (includes Federal lands, urban and built-up areas, and small water areas). The remaining 2 percent of the total area consists of large water areas. Principal mineral resources are: petroleum, sand and gravel, natural gas, and clays.

Transportation Facilities (Excluding Waterways)

Railroads

Railway transportation service for WRPA 4 is provided by main-line routes of the Illinois Central System which traverse the area in a north-south direction. Service is adequate and provides direct routes to New Orleans and to points in the north-central United States. With connections at major terminals outside the WRPA, freight can be moved to other states and to all sections of the Nation.

Highways

A network of interstate, Federal, and State highways within the WRPA offers adequate access to all sections and to other areas of the United States. Interstate Route 55 runs in a north-south direction and is located near the eastern boundary of WRPA 4. United States Route 61 traverses the western boundary and United States Route 82 crosses the mid-section from east to west. Other Federal and State highways provide additional transportation facility coverage.

Airlines

Scheduled airline service is limited to three urban areas located in WRPA 4. These Mississippi cities (Greenville, Cleveland, and Greenwood) are serviced by Southern Airlines and Mid-Continent Airlines. Modern airports and airlines in the area offer adequate transport, air-freight, and air charter service to all sections of the Nation.

Pipelines

Natural gas and crude oil pipelines cross WRPA 4 from the southwest to the northeast and from west to east. These lines have their origin in east Texas and the coastal areas of Louisiana.

EXISTING NAVIGATION IMPROVEMENTS

General

Table 32 presents a summary of existing navigation improvements. Detailed information can be found in Appendix D, Inventory of Facilities.

Table 32 - Existing Navigation Improvements, WRPA 4

<u>Waterway</u>	<u>Depth</u> feet	<u>Width</u> feet	<u>Length</u> miles	<u>Remarks</u>
Yazoo River	4 ft. & less during low water	100 min.	189	
<u>Ports</u>				
Greenville	12	250	4.5	Turning basin 500 feet wide.
Vicksburg	12	300	2.8	

Shallow-Draft Channels

Yazoo River

The River and Harbor Act of 3 March 1875 authorized navigation improvements on the Yazoo River from its mouth to the junction of the Tallahatchie and Yalobusha Rivers by removal of snags, wrecks, submerged logs, overhanging trees, and other obstructions in the channel. The mouth of the river, at its junction with the Mississippi River at Vicksburg, Miss., was improved under the provisions of the River and Harbor Act of 13 July 1892 (construction of Yazoo Diversion Canal).

Under the 1875 Act, no minimum channel depth for the Yazoo River was specified. The Corps of Engineers completed the initial phase of navigation improvements in 1888 and since that time has maintained the channel to a limited degree, depending on the demands for navigation. Since 1941, maintenance has consisted of removal of a rock ledge at approximate mile 18.0, a minor amount of dredging at isolated locations on the lower reach, and random clearing and snagging.

Under existing conditions, the following factors limit navigation on the Yazoo River:

Minimum channel depths of 9 feet or greater are available only about 46 percent of the time and this period of time is not consecutive. During low-water periods, controlling depths of 3 to 4 feet occur over the sand bars.

Numerous sharp bends restrict movement of the smallest tows (one or two barges and a towboat).

The fixed highway bridge at Belzoni (mile 116.1) restricts traffic upstream from that point during high river stages.

The river is navigable only during daylight hours due to the hazards encountered on the waterway.

Facilities for handling waterborne commerce on the Yazoo are limited.

Big Sunflower River

Navigation on the Big Sunflower River is currently inactive. Operation and maintenance of the project was abandoned under authority of the River and Harbor Act of 26 August 1937. Initial improvements to navigation on this stream were authorized under the River and Harbor Acts of 1907 and 1912. Improvements included one lock and dam (at mile 62.0 - Little Callao Landing) and channel improvement with a minimum depth of 4-1/2 feet to the head of project (mile 171.0 - mouth of Hushpuckena River). Operation of the project was from 1918 to 1937.

Other Streams

Navigation projects on other streams in WRPA 4 are inactive. The projects consisted of clearing and snagging operations on Steele and Washington Bayou, Lake Washington, Yalobusha River, Tallahatchie River, Little Tallahatchie River, and Coldwater River (see table 33).

Table 33 - Navigation Projects on Other Streams, WRPA 4

<u>Stream</u>	<u>Head of Navigation</u>	
	<u>Location</u>	<u>Miles above mouth</u>
Steele and Washington Bayous and Lake Washington, Miss.	Glen Allan	61.0
Yalobusha River, Miss.	Grenada	62.9
Tallahatchie River, Miss.	Mouth of Coldwater River	111.1
Little Tallahatchie River, Miss.	Batesville	29.3 ^{1/}
Coldwater River, Miss.	Yazoo Pass	40.1

^{1/} Via old channel prior to construction of Panola-Quitman Floodway.

Deep-Draft Channels

No deep-draft channels exist in WRPA 4.

Locks

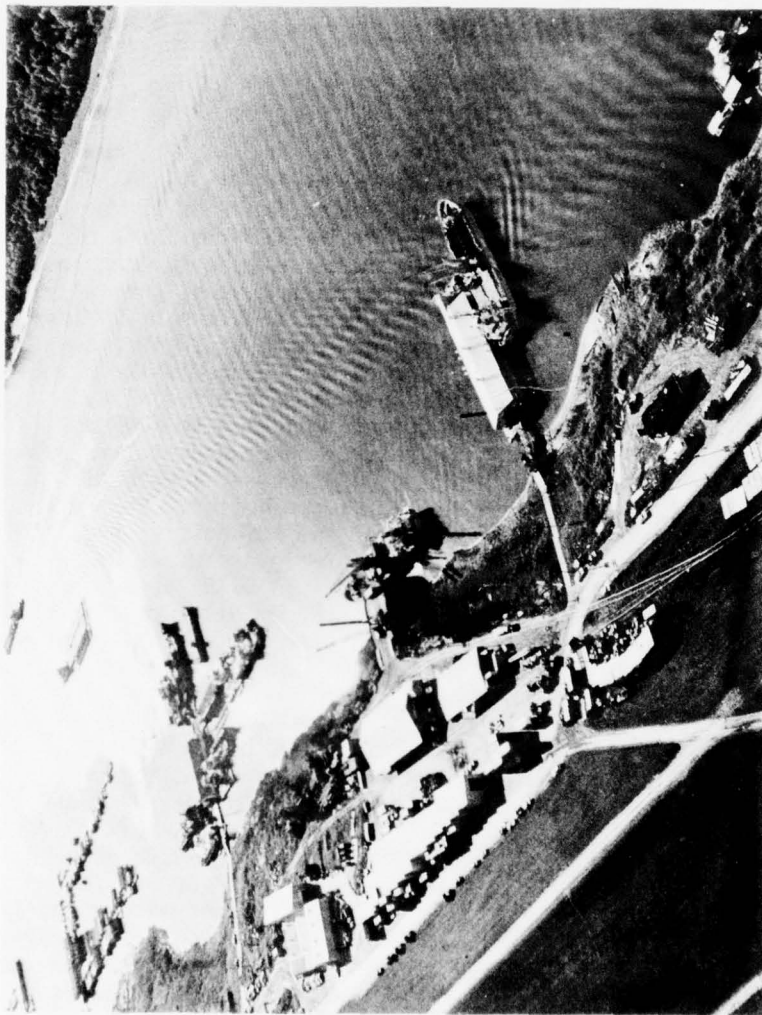
Currently, there are no locking facilities in WRPA 4.

Ports

Shallow Draft

Vicksburg Harbor. The Vicksburg Harbor project, completed in 1961, was constructed under authority of the Flood Control Act of 15 May 1928 and under amendments and modifications of the Flood Control Acts of 24 July 1946 and 3 September 1954. This project provided for construction of a harbor channel and an approach navigation channel generally along the north bank of Lake Centennial, northwest of Vicksburg, Miss. The harbor channel was constructed to a minimum depth of 12 feet and a width of 150 feet. The approach navigation channel connects the harbor channel to the existing Vicksburg Harbor. Excavated material from construction of the harbor and approach channel was used to form an industrial fill area and for highway and railway approaches to the site. The industrial fill area, with a width of 1,000 feet and length of 10,700 feet, contains 245 acres above project flood height. The Port of Vicksburg provides complete public terminal and warehousing facilities at the site. In addition, private facilities are in operation at the industrial site and the nearby Vicksburg Harbor. In 1970, approximately 2,000,000 tons of waterborne commerce were handled by all facilities at Vicksburg. Major commodities moved by water included: grains, petroleum products, construction materials, and wood and paper products.

Greenville Harbor. The harbor project at Greenville, Miss., was constructed under authority of the Flood Control Act of 15 May 1928, as amended by the Act of 3 July 1958. The project provided for construction of a harbor and port area on Lake Ferguson (an old bendway of the Mississippi River) just southwest of Greenville, Miss. Work consisted of dredging a harbor and turning basin 500 feet wide and 10,000 feet long to a depth of 12 feet at lowest river stages. The harbor is connected to the Mississippi River by a 250-foot-wide channel which is also 12 feet in depth. The port area, constructed with dredged spoil material, is 1,000 feet wide and 5,000 feet in length, which formed a flood-free area of 115 acres. This project was completed in 1963. Public port, terminal, and warehousing facilities, located at the upper end of the harbor on Lake Ferguson, were constructed by local interests. Existing private and public facilities consist of a public barge terminal, wharf, floating docks, pipeline facility, mooring facilities,



Port of Greenville, Miss.

Located on Lake Ferguson, just west of Greenville, the port presently offers 11 miles of slack water harbor with a channel 4.5 miles long, 250 feet wide, and 12 feet deep, which was completed in 1963. This growing port is already a beneficiary of new shipping trends as witnessed by the fact that it is home port in the U. S. for the Mini Line, described elsewhere in this appendix.

unloading derricks, and the revetment facilities of the Corps of Engineers. In 1970, all facilities at Greenville handled approximately 1,700,000 tons of waterborne commerce. Major commodities included: grains, construction materials, petroleum products, and wood and paper products.

Other facilities. Public terminal and warehousing facilities are located on the Jonestown Cutoff on the Yazoo River at Yazoo City, Miss. Spoil from this cutoff (constructed in 1957) was used for levee construction and to serve as an industrial fill area. Authorization of this improvement, just southwest of Yazoo City, was provided by the Flood Control Act of 15 May 1928, as amended by the Acts of 1936, 1937, 1938, 1941, 1944, and 1946. Private facilities (located on the Yazoo River) are located at Greenwood, Belzoni, Yazoo City, Satartia, and near Redwood, Miss. Major commodities currently handled by public and private facilities on the Yazoo include: chemicals, wood and paper products, grains, and construction materials. Approximately 238,000 tons moved through these ports in 1970.

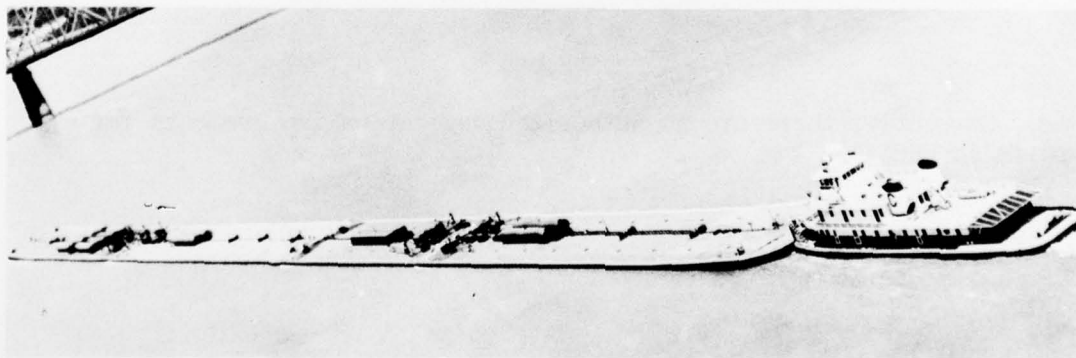
Other privately owned and operated port facilities within WRPA 4 are located near Vicksburg, Mayersville, Rosedale, and Dennis Landing, Miss. Waterborne commerce shipped and received by these facilities is transported on the Mississippi River. Principal commodities handled include: petroleum products, steel products, sand and gravel, heavy machinery and equipment, and grain.

Deep Draft

There are no deep-draft port facilities in WRPA 4.

Navigation Aids

The U. S. Coast Guard maintains all necessary aids to navigation on Federally constructed projects, and marks hazards to navigation.



Petroleum tow on the Mississippi River.

AUTHORIZED NAVIGATION IMPROVEMENTS

Shallow-Draft Channels

A navigation project for the Yazoo River was authorized in 1968, under authority of the River and Harbor Act of 1968 (HD 342/90/2). The project provides for construction of a lock and dam near Vicksburg, Miss., channel realignment and dredging from Vicksburg (mile 1.5) to Greenwood, Miss. (mile 164.9); addition of 600,000 acre-feet of storage in the existing Sardis Reservoir; and revision of regulation schedules for flood control in the existing Sardis, Enid, and Grenada Reservoirs. This project will provide a navigation channel (9-foot depth and 150-foot width) in all except infrequent periods of several weeks duration. Navigation on the Yazoo River would be available 97 percent of the time.

Deep-Draft Channels

There are no authorized deep-draft channel projects in WRPA 4.

Locks

Barge

One lock and dam (referred to in paragraph above) would be constructed in connection with the overall Yazoo navigation project. This lock and dam (84 ft by 600 ft) would be located at mile 4.2, just upstream from the existing Vicksburg Harbor project. The proposed lock would be of sufficient size to permit the use and interchange of modern barge traffic from connecting waterways and allow the expected average tow to pass in one lockage.

Ship

There are no authorized locks for ships in WRPA 4.

Ports

Currently, there are no authorized navigation improvements for ports in WRPA 4.

EXISTING COMMERCE

General

Waterborne commerce in WRPA 4 consists of commodities moving on the Yazoo and Mississippi Rivers. Total traffic is reported for the Yazoo River while only traffic originating in or destined for the 295 miles of Mississippi River bank in WRPA 4 on the Mississippi River is included. All of the through traffic on the Mississippi River is reported in WRPA 1. The total tons moved in 1970 were 5.9 million as shown in table 34.

Yazoo River and Yazoo River Ports and Harbors

Total tonnage reported on the Yazoo River in 1970 was 245,700. This represents 4 percent of the total tons in WRPA 4. Agricultural grains (primarily soybeans) and agricultural chemicals accounted for 86 percent of the total Yazoo tonnage. Other commodities accounting for relatively small percentages of the total tonnage include wood and paper, CSSA, industrial chemicals, and coal. Grain shipments to New Orleans, La., accounted for 134,600 tons while movements of agricultural chemicals to the Gulf Coast and New Orleans, La., accounted for 60,400 tons. Four major ports on the Yazoo River handled 97 percent of the tonnage. Yazoo City handled 49 percent; Greenwood, 22 percent; Belzoni, 16 percent; and Satartia, 10 percent. No foreign traffic was reported on the Yazoo River.

Mississippi River Ports and Harbors

Significant commodity groups for the Mississippi River ports in this area were petroleum, CSSA, grain and wood and paper. Petroleum shipments from Texas ports and New Orleans, La., accounted for 42 percent of the 5.7 million total WRPA 4 Mississippi River ports' and harbors' tonnage. CSSA shipments composed of sand, gravel, building material and waterway improvement materials accounted for 23 percent. Grain movements consisting of corn, wheat, and soybeans to New Orleans, La., amounted to 17 percent. Wood and paper shipments, consisting of log movements from various points along the Mississippi River, amounted to 10 percent of the total. The remaining 8 percent was distributed among iron and steel, industrial chemicals, agricultural chemicals, other and general cargo. Foreign traffic represents less than 1 percent of the total traffic.

The two major Mississippi River ports, Vicksburg and Greenville, handled 36 and 30 percent, respectively, of the Mississippi River tonnage in WRPA 4.

Vicksburg moved in excess of 2 million tons in 1970. Petroleum products comprised 32 percent of the total; grain, 24 percent; wood and

Table 34 - 1970 Waterborne Commerce, WRPA 4
(Thousand Short Tons)

Waterway or Port	Inland Traffic					General Cargo			
	Grain	Coal	Petroleum	CSSA	Iron & Steel	Industrial Chemicals	Agricultural Chemicals	Wood & Paper	Other
Yazoo River	150.2	1.4	-	7.1	-	4.9	60.4	12.4	9.3
Yazoo River Ports and Harbors									
Yazoo City	41.9	-	-	5.0	-	4.9	60.4	-	9.3
Greenwood	54.2	-	-	-	-	-	-	-	-
Belzoni	38.5	-	-	-	-	-	-	-	-
Sartoria	15.6	-	-	2.1	-	-	-	6.3	-
Other Private Terminals	-	1.4	-	-	-	-	-	6.1	-
Mississippi River Ports and Harbors									
Vicksburg	485.5	-	647.1	240.6	73.5	-	14.0	298.0	16.0
Greenville	171.6	-	669.2	578.1	57.0	10.0	18.4	180.2	-
Rosedale	-	-	-	44.2	-	-	-	18.1	-
Private Terminals ^{1/}	299.7	-	1,061.4	433.2	-	1.4	-	79.5	1.5
Subtotal	956.8	-	2,377.7	1,296.1	130.5	11.4	32.4	575.8	17.5
Foreign Traffic									
Mississippi River Ports and Harbors									
Vicksburg	.1	-	.1	2/	-	.1	2/	3.3	-
Greenville	-	-	-	.1	2.9	-	-	.3	.1
Subtotal	.1	-	.1	.1	2.9	.1	2/	3.6	.1
Total Commerce WRPA 4	1,107.1	1.4	2,377.8	1,303.3	133.4	16.4	92.8	591.8	26.9
									278.1
									5,929.0

^{1/} Private Terminals include all of those mentioned in the Existing Navigation Improvements Section plus other small landing sites.

^{2/} Less than 50 short tons.

paper, 15 percent; and CSSA, 12 percent. The remaining 17 percent was distributed among iron and steel, agricultural chemicals, other and general cargo. Greenville Harbor had 1970 movements of 1.7 million tons. Petroleum product movements accounted for 39 percent of the total; CSSA, 34 percent; wood and paper, 11 percent; and grain, 10 percent. The remaining 6 percent was composed of iron and steel, industrial chemicals, agricultural chemicals, and general cargo. Private terminals handled the remaining 34 percent which included primarily shipments of petroleum, CSSA, and grains.

Summary of WRPA 4 Waterborne Commerce

The total commerce for WRPA 4 in 1970 was 5.9 million tons. The largest movement involved petroleum, 40 percent of total. Following petroleum are CSSA, 22 percent; grain, 19 percent; and wood and paper, 10 percent. The remaining 9 percent was composed of coal, iron and steel, industrial chemicals, agricultural chemicals, other and general cargo. The Mississippi River ports and harbors moved 96 percent of the total. Vicksburg moved 34 percent of the total and Greenville, 29 percent, while private terminals accounted for the remainder.

Direct foreign traffic in WRPA 4 is a new innovation in shipping. The mini-ships and LASH barges were responsible for this introduction. In 1970, Greenville imported 308 tons of foreign goods via the mini-ships. Vicksburg and Greenville exported 3,841 and 3,250 tons, respectively. Although many of the tons reported for this WRPA are exported, they must be sent to New Orleans or some other port by barge and then be transferred to an ocean-going vessel. With the mini-ships and transferable LASH barges, these commodities need not be rehandled until they reach their ultimate destination. Presently, the foreign shipments consist of wood and paper, and iron and steel.

VESSEL COMPOSITION

Table 35 summarizes vessel movements within WRPA 4. Descriptions of typical vessels and tow composition are contained in the Regional Summary.

Table 35 - Vessel Trips, WSPA 4, 1970

Harbor or Waterway	Upbound Trips				Downbound Trips							
	Self-Propelled Vessels		Non-Self-Propelled Vessels		Self-Propelled Vessels		Non-Self-Propelled Vessels					
	Passenger &	Towboat or	Dry Cargo Tanker	Total	Passenger &	Towboat or	Dry Cargo Tanker	Total				
	Dry Cargo	Tugboat			Dry Cargo	Tugboat						
Mouth of Yazoo River, Miss.	22	0	323	1,015	186	1,546	22	0	322	1,014	184	1,542
Yazoo River, Miss.	0	0	150	186	9	345	0	0	148	185	8	341

FUTURE NEEDS

Prospective Commerce

General

Waterborne commerce in the selected commodity categories was projected in accordance with indices of output developed for the appropriate major industry groups. These indices are shown on table 36. In general, the Program A indices represent OBER'S forecast of economic growth for the individual WRPA's within the Lower Mississippi Region. Program B indices were developed to reflect a regional growth in employment equal to the national average, 1.4 percent^{1/}. Application of these indices to the base year tonnages shown previously on table 34 yield future levels of commerce as shown in aggregate on table 37. These levels are designated as the gross needs of the area. Note that the projections are expressed in ton-miles for the waterways and in short tons for the ports.

Inland Traffic

Projected Program A ton-miles for the inland traffic of the Yazoo River for 1980, 2000, and 2020 are 67.2 million, 538.6 million, and 860.9 million, respectively, as shown on table 37. Projected inland tonnage for ports and harbors of the Yazoo River are 0.7 million, 5.4 million, and 8.6 million for 1980, 2000, and 2020, respectively. The large increase between 1980 and 2000 is due to the anticipated completion of the Yazoo River navigation project by 1983. Similar projected tons for the Mississippi River ports and harbors are 8.8 million, 17.1 million, and 28.6 million for 1980, 2000, and 2020, respectively.

It is projected that the majority of tons on the Mississippi River will go through the ports of Vicksburg and Greenville. On the Yazoo River, the majority of tons will go through Yazoo City, Greenwood, and Belzoni. The private terminals along the Mississippi will continue to maintain their relative share of the total tons. Private terminals are privately owned and are not open to the general public.

Foreign Traffic

Program A projected foreign traffic for the ports and harbors of the Mississippi River are 11,200, 22,800, and 37,200 tons for 1980, 2000, and 2020, respectively. These projections were based on the tonnage the first year the mini-ship was introduced to the area and prior to the introduction of the LASH barges. Both of these innovations will have a tremendous impact on the direct foreign shipments to and from WRPA 4. Since quite a large amount of the exports from this area

^{1/} Further discussion of these indices and their derivations is contained in Appendix B, "Economics."

Table 36 - Economic Forecast, WRPA 4
Index of Productivity by Major Industries

Commodity (Industry Group)	Program	1967	1968	1970	1980	2000	2020
Grain (Soybeans)	A			100	162	200	234
	B				162	220	251
Coal (National Coal Growth Rate)	A	100	104	109	143	199	323
	B				157	230	381
Petroleum (Mining and Refining, Average)	A	100	98	110	173	339	654
	B				190	392	772
CSSA (Quarrying)	A	100	104	110	139	233	408
	B				152	269	481
Sulphur (Held Constant)	A	100	100	100	100	100	100
	B				100	100	100
Iron and Steel (National I & S Growth Rate)	A	100	103	109	141	218	340
	B				155	252	401
Industrial Chemicals (Chemical and Allied Products)	A	100	107	121	192	469	1,120
	B				211	542	1,321
Agricultural Chemicals (Agriculture)	A			100	137	158	180
	B				137	169	193
Aluminum (Primary Metals)	A	100	147	156	204	361	637
	B				224	418	751
Wood and Paper (Forestry)	A			100	86	138	148
	B				109	187	268
Other (Chemical and Allied Products)	A	100	107	121	192	469	1,120
	B				211	542	1,321
General Cargo (Other Manufacturing)	A	100	107	122	199	529	1,294
	B				219	612	1,526

Table 37 - Present and Prospective Waterborne Commerce, WRPA 4

Waterway or Port	1970	Program A		Program B	
	Commerce	1980	2000	1980	2000
		Shallow Draft			
Yazoo River (Ton Miles 10 ³)	24,542.0	67,216.0	538,646.8	237,298.7	622,974.0
Yazoo River Ports and Harbors (Tons 10 ³)					
Yazoo City	121.6	329.7	2,642.3	1,164.0	3,056.0
Greenwood	54.2	148.0	1,186.3	522.6	1,372.0
Belzoni	38.5	107.7	862.8	380.1	997.9
Sartatia	23.9	67.3	539.2	237.6	623.6
Other	7.5	20.2	161.8	71.3	187.1
Subtotal	245.7	672.9	5,392.4	2,375.6	6,236.6
Mississippi River Ports and Harbors (Tons 10 ³)					
Vicksburg	2,032.1	3,480.0	8,033.7	3,815.4	9,291.5
Greenville	1,698.3	2,211.1	3,685.5	2,424.1	4,262.5
Rosedale	62.3	362.5	491.3	397.2	568.2
Private Terminals ^{1/}	1,883.2	2,781.3	4,936.0	3,049.3	5,708.7
Subtotal	5,675.9	8,834.7	17,146.5	9,686.0	19,830.9
		Foreign Traffic			
Mississippi River Ports and Harbors (Tons 10 ³)					
Vicksburg	3.8	6.5	15.0	7.1	17.3
Greenville	3.6	4.7	7.8	5.2	9.0
Subtotal	7.4	11.2	22.8	12.3	26.3
TOTAL	5,929.0	9,518.8	22,561.7	12,073.9	26,093.8
					43,991.9

Foreign Traffic

^{1/} Private Terminals include all of those mentioned in the Existing Navigation Improvements Section plus other small landing sites.

are destined for foreign countries via New Orleans, it is quite possible these will start going directly to foreign ports via mini-ships and LASH barges.

Total Projected Commerce

Total projected Program A commerce for WRPA 4 ports and harbors is 9.5 million, 22.6 million, and 37.3 million tons for 1980, 2000, and 2020, respectively. These total tons represent an annual growth rate of 3.75 percent between 1970-2020.

Program B projections were derived as a multiple of Program A tons. The factors applied are 9.6 percent, 15.7 percent, and 17.9 percent greater than Program A projections in 1980, 2000, and 2020, respectively.

Net Needs

General

Navigation needs data are shown in table 38 for Programs A and B, respectively. The table includes the gross needs for each projected time period, the needs to be satisfied by projects assumed to be completed for each projected time period, and the net needs which are the needs that will require some type of navigation construction work to satisfy. The various type navigation improvements are also shown.

Shallow- and Deep-Draft Channels

There are no navigation needs presently estimated in WRPA 4 that would require shallow- or deep-draft channel type construction work.

Ports and Harbors

A need for port and harbor development exists in WRPA 4. Slack-water inland harbors located off river mainstems are needed to provide areas for loading and unloading facilities and also fleeting areas. The spoil from harbor construction will likely be used for industrial fill. The net needs are shown in table 38 for Programs A and B, and were assumed to be equal to the total projected tonnage less the tonnage presently handled by existing facilities. No attempt was made to determine capacity of the existing facilities. Net needs for Program A for 1980, 2000, and 2020, are 5,083,700; 16,632,700; and 31,370,300 tons, respectively.

Table 38 - Navigation Needs, WRPA 4

Item	Program A			Program B		
	1970	1980	2000	1980	2000	2020
Deep-draft Channels (10 ⁶ Ton-Miles)						
New Channels						
Gross Need			NONE		NONE	
Existing Supply						
Net Need						
Existing Facilities Improvement						
Gross Need						
Existing Supply			NONE		NONE	
Net Need						
Shallow-draft Channels (10 ⁶ Ton-Miles)						
New Channels						
Gross Need			NONE		NONE	
Existing Supply						
Net Need						
Existing Facilities Improvement						
Gross Need						
Existing Supply			NONE		NONE	
Net Need						
Deep-draft Navigations Locks (# Ship Lockages)						
Gross Need						
Existing Supply			NONE		NONE	
Net Need						
Shallow-draft Navigation Locks (10 ³ Tons)						
Gross Need	245.7	672.9	5,392.4	737.7	6,236.6	10,164.3
Existing Supply	245.7	245.7	5,392.4	245.7	6,236.6	10,164.3
Net Need	0	427.2	0	492.0	0	0

Table 38 - Navigation Needs, WRPA 4 (cont.)

Item	Program A			Program B		
	1970	1980	2000	1980	2000	2020
Deep-draft Harbors and Ports (10 ³ Tons)						
Gross Need					NONE	
Existing Supply						
Net Need						
Shallow-draft Harbors and Ports (10 ³ Tons)						
Gross Need	5,929.0	9,518.8	22,561.7	12,073.9	26,093.8	43,991.9
Existing Supply	5,929.0	5,929.0	5,929.0	5,929.0	5,929.0	5,929.0
Net Need	0	3,589.8	16,632.7	6,144.9	20,164.8	38,062.9

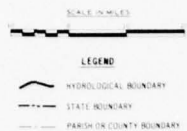


FIGURE 5

W R P A 5

GENERAL DESCRIPTION

The Ouachita Water Resource Planning Area consists of all or part of 34 counties and parishes in south-central Arkansas and north-central Louisiana.

The Ouachita River Basin extends generally from the Arkansas River Drainage Basin in the north section, southeastward to the west bank Mississippi River levees near the mouth of the Red River. It is bounded on the west and southwest by the Red River Basin and bounded on the east by the Boeuf-Tensas Basin. The Ouachita River originates in the Ouachita Mountains near Mena, Ark. (Polk County), flows eastward about 160 miles through rugged terrain to the vicinity of Malvern, Ark., then flows southwestward for 24 miles and southeastward for 70 miles through hilly uplands to Camden, Ark. (mile 351), flows southeastward 132 miles through wide bottoms in hilly terrain, then southward for 224 miles through the alluvial valley of the Mississippi River, and enters Red River 36 miles above its mouth.

The Ouachita River is joined at intervals throughout its entire length by numerous tributary streams. Principal tributary streams include: Saline River, Bayou Bartholomew, Little Missouri River, Caddo River, Little River, Bayou D'Arbonne, Bayou De L'Outre, Boeuf River, Tensas River, Smackover Creek, and Moro Creek.

The climate of the Ouachita WRPA is mild, with an average annual temperature of 65° F. The freeze-free season averages about 230 days.

Existing Economic Development

In 1968, total employment was estimated at 273,000 persons, an increase of 12.4 percent over the number reported in 1959. Employment in manufacturing and other industries (excluding agricultural, forestry and fisheries and mining) accounts for the majority of the number of persons employed. Manufacturing and other industries also contribute 90 percent of the total earnings (\$1.4 billion in 1968) reported for all industries. Earnings shown as a percent of total by major industry groups include: agriculture, forestry and fisheries, and mining, 10 percent; manufacturing, 25 percent; and other industries, 65 percent. Principal manufacturing industries in WRPA 5 include: paper and allied products, chemicals and allied products, petroleum refining, food and kindred products, and primary metals.

Agricultural land, extensive woodlands, mineral deposits, hydroelectric power, and wildlife are the principal natural resources of the area. Fertile lands are the basic resource and this resource has been responsible for a strong agricultural oriented economy. Forestry resources are responsible for much of the area's industrialization. In some sectors, forestry is the principal industry. Mineral resources (petroleum, sand and gravel, natural gas, and bauxite), which have been important to the economy, could provide future development potentials. Lands used for agricultural purposes account for 95 percent of the total land and water resources in WRPA 5. Agricultural use consists of: land in farms, 29 percent of total; lands in forests, 67 percent; and other nonfarm use, 4 percent. Four percent of the total land and water resources is in non-agricultural use. Non-agricultural use consists of Federal lands, urban and built-up areas, and small water areas. Large water areas account for the remaining 1 percent of the total area.

Transportation Facilities (Excluding Waterways)

Railroads

Four major railroad lines, the Missouri Pacific, St. Louis and Southwestern; Chicago, Rock Island and Pacific; and Illinois Central Railway serve the Ouachita Water Resource Planning Area. Direct routings are provided to points in the southwest United States; to New Orleans, La.; points to the north and east; and to destinations in the southeastern United States. Connections with other railways provide access to any area of the Nation.

Highways

Two interstate highways cross WRPA 5--I-30 in the upper portion and I-20 in the southern section. These highways provide access to the west and southwest, to the northeast, and eastern United States. Other modern Federal and State highways traverse the area from all directions providing transport to adjoining states. Major United States Routes 70, 67, 79, and 82 cross the upper and middle section and United States Routes 80, and 84 cross the southern section. Numerous truck lines provide common, contract, and specialized transport.

Airlines

Scheduled airline service is available in Hot Springs, Pine Bluff, Camden, and El Dorado, Ark.; Alexandria and Monroe, La. Four major airlines (Delta, Texas International, Southern, and Central) provide transportation for the region with connections to all areas of the United States. Aircargo service is also furnished by these airlines. Charter air service is available from private firms. Airports are modern and provide up-to-date flight service and traffic control.

Pipelines

Numerous natural gas, crude oil, and refined products pipelines traverse WRPA 5 from the southwest to the northeast and from south to north. The majority of these lines originate in east Texas and the coastal Louisiana areas. Some lines originate in the El Dorado oil and gas production area.

EXISTING NAVIGATION IMPROVEMENTS

General

Table 40 presents a summary of existing navigation improvements. Detailed information can be found in Appendix D, Inventory of Facilities.

Shallow-Draft Channels

The original navigation project on the Ouachita-Black Rivers, which provided for clearing and snagging the channel from Arkadelphia, Ark., to the mouth, was authorized under provisions of the River and Harbor Act of 3 March 1871.

In addition to improvements on the Ouachita-Black Rivers, the following tributary streams in WRPA 5 have been improved in past years for navigation by clearing and snagging (see table 39). No commerce is presently being moved on these tributary streams and these projects are now considered inactive.

Table 39 - Navigation Projects on Tributary Streams, WRPA 5

<u>Stream</u>	<u>Date of last improvement</u>	<u>Head of Navigation</u>	
		<u>Location</u>	<u>Miles above mouth</u>
Bayou Bartholomew, La. and Ark.	1897	Baxter, Ark.	184.0
Saline River, Ark.	1911	Turtle Bar	117.0
Little Missouri River, Ark.	1873	Rawles Landing	23.0
Bayous D'Arbonne and Corney, La.	1896	Cobb Landing	57.0

The existing navigation project, on the Ouachita-Black Rivers, with 6-1/2-foot minimum channel depth in conjunction with six locks and dams, was authorized under provisions of the River and Harbor Act of 13 June 1902. A detailed study, completed in 1900, was the basis for determining the feasibility and authorization of the navigation project on the Ouachita-Black River from its mouth to Camden, Ark., mile 351. The existing project was completed in 1926 except for construction of the Felsenthal Canal. This navigation project (which, when constructed, had one of the least costs per mile for canalized projects in the United States) provided in recent years only limited use of the waterway due to outmoded facilities, limited channel development, etc., which precluded efficient movement of tonnage and retarded economic development of the area.

The River and Harbor Act of 17 May 1950 (SD/117/81/1) as modified by the Act of 14 July 1960 (SD/112/86/2) provided for the modification of the existing 6-1/2-foot navigation project to a 9-foot project. The 9-foot project (9-foot minimum depth and 100-foot bottom-width channel with four locks and dams) will provide for year-round navigation on the Ouachita-Black from the mouth to mile 351 at Camden, Ark. This improvement will include channel rectification, cutoffs, and dredging of the channel in Red River from Old River to the mouth of the Black River at mile 35.5, thence from the mouth of Black River to Camden, Ark., on the Ouachita River. The project also provides for modifications of existing structures as required and the release of additional flows during the low-water season from Narrow, Blakely, and DeGray multiple-purpose reservoirs.

The Jonesville Lock and Dam, which is the first of the four new locks in the Ouachita-Black 9-foot navigation project, was opened to traffic on 2 March 1972. This structure now provides a 9-foot slack-water channel for 107 miles up the Ouachita River, 69 miles up the Tensas River, 13 miles up Little River and 32 miles up Boeuf River. The Columbia Lock and Dam (opened to commercial traffic on 4 May 1972) provides for 9-foot channel depths on the Ouachita to the vicinity of the Arkansas-Louisiana state line.

There are no known navigation improvements in the Ouachita WRPA constructed by local interests except the terminal and transfer facilities discussed in subsequent paragraphs.

Deep-Draft Channels

There are no existing deep-draft channels within WRPA 5.

Table 40 - Existing Navigation Improvements, WRPA 5

<u>Waterways</u>		<u>Depth</u> <u>feet</u>	<u>Width</u> <u>feet</u>	<u>Length</u> <u>miles</u>	<u>Remarks</u>
Ouachita-Black Rivers		6.5	100	351	9-foot channel currently under construction
<u>Ports</u>					
Pine Bluff		43		5.0	
<u>Locks</u>	<u>Depth over Sill</u> <u>feet</u>	<u>Width</u> <u>feet</u>	<u>Length</u> <u>feet</u>	<u>Open to</u> <u>Navigation</u>	<u>Remarks</u>
#2	21.3	55	268	1912-1924	Replaced by Jonesville Lock
#3	21.3	55	268	1912-1924	Replaced by Columbia Lock
#4	15.4	55	268	1912-1924	Replaced by Columbia Lock
#5	13.5	55	268	1912-1924	Replaced by Columbia Lock
#6	13.8	55	268	1912-1924	To be replaced by Felsenthal Lock
#8	16.0	55	268	1912-1924	Construction scheduled to begin 1973
Columbia	18.0	84	600	1972	To be replaced by Calion Lock
Jonesville	18.0	84	600	1972	Construction date not scheduled

Locks

Barge

As noted above, six locks and dams (Nos. 2, 3, 4, 5, 6, and 8) were constructed on the Ouachita-Black Rivers as an integral part of the 6-1/2-foot navigation project, authorized under provisions of the River and Harbor Act of 13 June 1902. These locks were opened to navigation between 1912 and 1924. The locks, which measure 55 ft by 268 ft, were of movable steel and wood wickets on a concrete base which permitted the lowering of the dams during high-water seasons to allow for open river navigation.

The four new locks and dams, which measure 84 ft by 600 ft, will replace existing locks and dams Nos. 2, 3, 4, 5, 6, and 8. These four locking facilities, authorized under the River and Harbor Acts of 1950 and 1960, are an integral part of the 9-foot navigation project. These structures will be located on the Ouachita-Black Rivers near Jonesville, La., Columbia, La., Calion, Ark., and Felsenthal, Ark. They are of sufficient size to permit the use and interchange of modern barge traffic from connecting waterways and permit the average tow to pass in one lockage. Thus, when operated with the 9-foot channel improvements and flow releases from upstream reservoirs, these new locks and dams will provide for maximum efficiency of cargo movement by water. Construction of the locks and dams at Jonesville and Columbia, La., is complete, thus providing a 9-foot slack-water channel to the Arkansas-Louisiana line. Felsenthal Lock and Dam is scheduled for completion in 1976. No completion date has been set for the Calion Lock and Dam.

In connection with the existing Ouachita-Black navigation system, all barge traffic must pass through another lock located in Old River (between Mississippi River and junction of the Red and Atchafalaya Rivers) to gain access to the Ouachita-Black waterway. This Old River lock (which measures 75 ft by 1,200 ft) is a part of an overall project authorized by Public Law No. 780, 83rd Congress, 3 September 1954, and was a modification of the Flood Control Act of 15 May 1928. The Old River Lock and Dam (in WRPA 9) was a part of several improvements on and near Old River which are to provide for control of flows from the Mississippi River to the Atchafalaya River and Basins. The lock was opened to navigation on 15 March 1963.

There are no locking facilities on other streams of WRPA 5.

Ship

There are no locking facilities for ships in WRPA 5.

Ports

Shallow Draft

In 1970, the total waterborne tonnage handled by all private and public port facilities within WRPA 5 amounted to approximately 951,800 tons. Waterborne commerce movements on the Ouachita-Black waterway system accounted for the major portion (64 percent) of all tonnages reported for this WRPA. The remaining 36 percent (346,300 tons) was handled through the public and private facilities at Pine Bluff Port, Jefferson County, Ark. Major commodities currently being shipped via waterborne commerce in WRPA 5 include: grains and other agricultural products; stone, sand, and gravel; iron and steel; coal; petroleum products; chemicals; and lumber and wood products.

Pine Bluff Harbor. Pine Bluff is the first port city reached by navigation on the Arkansas River. The facility is located on an abandoned river channel approximately 72 river miles upstream from the confluence of the Arkansas and Mississippi Rivers. The 372-acre port site, which is comprised of the public terminal area and the harbor industrial district, was constructed by local interests in 1969. The area was hydraulically filled to a flood-free elevation. Dredging created a channel depth of about 43 feet (5 miles of the harbor channel is navigable). Public terminal and transfer facilities include: complete on- and off-loading equipment for barge, rail, and trucks; wharf and mooring facilities; and storage for various products. The terminal is adjacent to other transportation facilities and the city of Pine Bluff. Private facilities are also constructed on the harbor industrial area.

Other port facilities. Privately owned port facilities on the Ouachita-Black Rivers are located at Camden, Calion, Champagnolle, and Moro Bay, Ark.; Sterlington, Monroe, Rilla, Riverton, Columbia, Jonesville, and Acme, La.

Deep Draft

There are no deep-draft port facilities in WRPA 5.

Navigation Aids

The U.S. Coast Guard maintains all necessary aids to navigation on Federally constructed projects, and marks hazards to navigation.

AUTHORIZED NAVIGATION IMPROVEMENTS

There are no authorized navigation improvements in WRPA 5 on which construction has not been initiated. The authorized 9-foot navigation project on the Ouachita-Black Rivers is under construction with two of the four locks and dams now complete.

EXISTING COMMERCE

General

A summary of existing commerce by commodity groups is presented in table 41 for WRPA 5. Total waterborne commerce amounted to 951,800 tons. Major ports on the Ouachita-Black Rivers handled 562,200 tons and the Pine Bluff Port on the Arkansas River handled 307,400 tons. Small private terminals handled the remaining 82,200 tons.

Ouachita-Black Rivers

Major commodities moving on the Ouachita-Black Rivers were industrial chemicals, 39 percent; petroleum, 24 percent; wood and paper, 17 percent; and grain, 12 percent. The remaining 8 percent was composed of CSSA and general cargo.

The major ports on the Ouachita-Black contributed 93 percent of the tons reported in 1970. Sterlington had the largest contribution with 36 percent of the river tons either entering or leaving this port. Monroe had 23 percent; Calion, 17 percent; Jonesville, 12 percent; and Columbia, 5 percent. Sterlington handled primarily industrial chemicals; Monroe, petroleum; Calion, wood and paper; Jonesville, grain, petroleum, and CSSA; and Columbia, petroleum and industrial chemicals.

Arkansas River Ports and Harbors

Principal commodities handled through the Pine Bluff Port area were chemicals, 33 percent; sand and gravel, 42 percent; and iron and steel, 2 percent. Private terminals located within WRPA 5 and east of Pine Bluff, Ark., handled 38,926 tons, 89 percent of which was grain.

No foreign traffic was reported in WRPA 5 for 1970.

Table 41 - 1970 Waterborne Commerce, WRPA 5

Waterway or Port	Grain	Petroleum	COSA	Inland Traffic			Wood & Paper	General Cargo	Total
				Thousand Short Tons					
Ouachita-Black Rivers	74.4	142.5	17.2	-	234.4	100.8	36.2	605.5	
Ouachita-Black Rivers Ports and Harbors									
Sterlington	-	-	-	-	217.9	-	-	217.9	
Monroe	-	105.5	-	-	-	-	33.8	139.3	
Calion	-	-	-	-	-	100.8	-	100.8	
Jonesville	33.6	22.8	17.2	-	-	-	-	73.6	
Columbia	-	14.1	-	-	16.5	-	-	30.6	
Other Private Terminals	40.8	0.1	-	-	-	-	2.4	43.3	
Arkansas River Ports and Harbors									
Pine Bluff	-	-	130.0	6.2	101.5	-	69.7	307.4	
Other Private Terminals	34.6	-	-	-	-	4.3	-	38.9	
Subtotal	34.6	-	130.0	6.2	101.5	4.3	69.7	346.3	
Total Commerce WRPA 5	109.0	142.5	147.2	6.2	335.9	105.1	105.9	951.8	

VESSEL COMPOSITION

Shallow-Draft Vessels

Table 42 summarizes commercial vessel movements in WRPA 5 for 1970.

The vessels on the Ouachita-Black Rivers in 1970 consisted of tugs, liquid and dry cargo barges, an excursion boat in the Monroe, La., area, and a school boat for ferrying school children across the river at Jonesville, La. Total combined vessel trips upbound were 1,051; total combined vessel trips downbound were 1,054.

Thirty-eight percent of the vessel trips on the Ouachita-Black Rivers was school ferry or excursion boats requiring 3 feet or less draft. Barge trips consisted of 50 percent liquid and 50 percent dry cargo.

Nineteen percent of the upbound trips and 27 percent of the downbound trips required drafts greater than 6-1/2 feet now maintained on the river. Further descriptions of vessels and tow composition are contained in the Regional Summary.

FUTURE NEEDS

Prospective Commerce

General

Waterborne commerce in the selected commodity categories was projected in accordance with indices of output developed for the appropriate major industry groups. These indices are shown on table 43. In general, the Program A indices represent OBERS' forecast of economic growth for the individual WRPA's within the Lower Mississippi Region. Program B indices were developed to reflect a regional growth in employment equal to the national average, 1.4 percent^{1/}. Application of these indices to the base year tonnages shown previously on table 41 yield future levels of commerce as shown in aggregate on table 44. These levels are designated as the gross needs of the area. Note that the projections are expressed in ton-miles for the waterways and in short tons for the ports.

^{1/} Further discussion of these indices and their derivations is contained in Appendix B, Economics.

Inland Traffic

Projected ton-miles for the Ouachita-Black Rivers are 209.9 million, 379.2 million, and 719.6 million for the years 1980, 2000, and 2020, respectively. Future tons for the major ports of the Ouachita-Black Rivers were projected at 1.6 million, 2.8 million, and 5.4 million for 1980, 2000, and 2020, respectively. Projections for the Pine Bluff Port and other WRPA 5 Arkansas River terminals were estimated to be 651,200, 912,700, and 1,334,800 tons for 1980, 2000, and 2020, respectively.

Total Projected Commerce

Total projected tons for all ports and harbors in WRPA 5 were 2.2 million, 3.8 million, and 6.7 million for 1980, 2000, and 2020, respectively. The average annual growth rate of Program A for WRPA 5 is 4 percent.

Program B tons were derived as a multiple of Program A tons and factors developed in the Economic Appendix B. They are 9.6 percent, 15.7 percent, and 17.9 percent greater than Program A in 1980, 2000, and 2020, respectively.

Net Needs

General

Navigation needs data are shown in table 45 for Programs A and B. The table includes the gross needs to be satisfied for each projected time period, the needs to be satisfied by projects assumed to be completed for each projected time period, and the net needs which are the needs that will require some type of navigation construction work to satisfy. The various type navigation improvements are also shown.

Shallow- and Deep-Draft Channels

There are no navigation needs presently estimated in WRPA 5 that would require shallow- or deep-draft channel type construction work.

Ports and Harbors

A need for port and harbor development exists in WRPA 5. Slackwater inland channels located off river mainstems are needed to provide areas for loading and unloading facilities and also fleeting areas. The spoil from harbor construction will likely be used for industrial fill. The net needs are shown in table 45 for Programs A and B, and were assumed to be equal to the total projected tonnage less the tonnage presently handled by existing facilities. No attempt was made to determine capacity of the existing facilities. Net needs for Program A for 1980, 2000, and 2020 are 1,274,700; 2,806,700, and 5,782,900 tons, respectively. Program B needs were calculated similarly to the Program B lock needs.

Table 43 - Economic Forecast, WRPA 5
Index of Productivity by Major Industries

Commodity (Industry Group)	Program	1967	1968	1970	1980	2000	2020
Grain (Weighted Average)	A			100	249	306	357
	B				249	329	383
Coal (National Coal Growth Rate)	A	100	104	109	143	199	323
	B				157	230	381
Petroleum (Mining and Refining, Average)	A	100	112	120	160	256	444
	B				176	296	524
CSSA (Quarrying)	A	100	94	98	120	174	262
	B				132	201	309
Sulphur (Held Constant)	A	100	100	100	100	100	100
	B				100	100	100
Iron and Steel (National I & S Growth Rate)	A	100	103	109	141	218	340
	B				155	252	401
Industrial Chemicals (Chemical and Allied Products)	A	100	114	126	188	437	999
	B				206	505	1,178
Agricultural Chemicals (Agriculture)	A			100	142	213	218
	B				142	229	234
Aluminum (Primary Metals)	A	100	120	133	196	380	699
	B				215	439	824
Wood and Paper (Forestry)	A			100	142	179	197
	B				146	185	211
Other (Chemical and Allied Products)	A	100	114	126	188	437	999
	B				206	505	1,178
General Cargo (Other Manufacturing)	A	100	103	117	186	442	998
	B				203	511	1,177

Table 44 - Present and Prospective Waterborne Commerce, WPPA 5
Shallow Draft

Waterway or Port	1970 Commerce	Program A		Program B	
		1980	2000	1980	2020
Quachita-Black Rivers (Ton Miles 10 ³)	80,687.9	209,924.5	379,231.3	229,704.3	847,050.4
Quachita-Black Rivers Ports and Harbors (Tons 10 ³)					
Sterlington	217.9	587.7	1,323.3	644.3	3,546.3
Monroe	139.3	345.1	598.4	378.3	1,550.7
Callion	100.8	259.1	315.8	284.0	407.5
Jonesville	73.6	253.1	329.7	277.5	530.5
Columbia	30.6	39.8	61.5	43.6	125.3
Other Private Terminals	43.3	90.5	217.1	99.4	408.5
Subtotal	605.5	1,575.3	2,845.8	1,727.1	6,368.8
Arkansas River Ports and Harbors (Tons 10 ³)					
Pine Bluff	307.4	558.9	799.1	612.8	1,418.6
Other Private Terminals	38.9	92.3	113.6	101.2	155.7
Subtotal	346.3	651.2	912.7	714.0	1,574.3
TOTAL	951.8	2,226.5	3,758.5	2,441.1	7,943.1

Table 45 - Navigation Needs, WRPA 5

Item	Program A		Program B	
	1970	1980 2000	1980 2000	2020
Deep-draft Channels (10 ⁶ Ton-Miles)				
New Channels				
Gross Need		NONE	NONE	
Existing Supply				
Net Need				
Existing Facilities Improvement				
Gross Need		NONE	NONE	
Existing Supply				
Net Need				
Shallow-draft Channels (10 ⁶ Ton-Miles)				
Gross Need		NONE	NONE	
Existing Supply				
Net Need				
Existing Facilities Improvement				
Gross Need		NONE	NONE	
Existing Supply				
Net Need				
Deep-draft Navigation Locks (# Ship Lockages)				
Gross Need		NONE	NONE	
Existing Supply				
Net Need				
Shallow-draft Navigation Locks (10 ³ Tons)				
Gross Need		NONE	NONE	
Existing Supply				
Net Need				

Table 45 - Navigation Needs, WRPA 5 (cont'd)

Item	Program A			Program B		
	1970	1980	2000	1980	2000	2020
Deep-draft Harbors and Ports (105 Tons)						
Gross Need			NONE		NONE	
Existing Supply						
Net Need						
Shallow-draft Harbors and Ports (105 Tons)						
Gross Need	951.8	2,226.5	3,758.5	2,441.1	4,346.8	7,943.2
Existing Supply	951.8	951.8	951.8	951.8	951.8	951.8
Net Need	0	1,274.7	2,806.7	1,489.3	3,395.0	6,991.4



LOWER MISSISSIPPI REGION
COMPREHENSIVE STUDY
**MAJOR STREAMS AND
NAVIGABLE WATERWAYS**
WRPA-5

FIGURE 6

W R P A 6

GENERAL DESCRIPTION

Water Resource Planning Area 6 consists of all or part of 10 counties and parishes in Arkansas and Louisiana otherwise known as the Boeuf-Tensas Basin.

The drainage basins of the Boeuf and Tensas Rivers and Bayou Macon are contiguous and embrace that part of the alluvial valley west of the Mississippi River, which is south of the Arkansas River levee (south bank), and east of the Ouachita River Basin between Pine Bluff, Ark., and Harrisonburg, La. The basin has an overall length of about 190 miles in a generally north-south direction and averages about 30 miles in width.

Streams which are tributary to the Boeuf and Tensas Rivers and Bayou Macon include: Big and Colewa Creeks, Bayou LaFourche, Big Bayou, Fleschmans Bayou, Caney Bayou, and Rush Bayou.

WRPA 6 experiences weather conditions which are mild - with an average annual temperature of 65° F. The average frost-free period is 230 days. Rainfall in the area is uniform, with an average annual amount of 52 inches. Heavy winter and spring rains are characteristic.

Existing Economic Development

Total employment was estimated at 54,000 in 1968. This amount did not change significantly in the prior 10 years. In 1968, earnings from all industries were approximately \$291 million. Earnings contributed by the agricultural sector, which continues to be an important segment of the total economy, amounted to 36 percent of total earnings for all industries. Manufacturing contributed only 12 percent of total earnings. Specific industries in the manufacturing sector contributed little to total earnings.

The fertile delta soil, which is well suited for agricultural production, is the most valuable resource of WRPA 6. Currently, 94 percent of the total land and water area is in agricultural use. Lands in agricultural use consist of 60 percent in farms, 30 percent in forest lands, and 10 percent in other nonfarm land. Lands used for non-agricultural purposes (3 percent of total) and large water areas (3 percent) account for the remainder of the total land and water resources. Mineral resources, found mainly in the southern section of this WRPA, include petroleum and natural gas.

Transportation Facilities (Excluding Waterways)

Railroads

Adequate service is provided WRPA 6 by two major railroads (Missouri Pacific and Illinois Central). These lines cross the area from north to south and east to west, respectively. Routings are available to provide transport to adjoining states and connections to all sections of the Nation.

Highways

A network of highways--interstate, Federal, and State--provide adequate transport to adjoining trade areas and to all points in the United States. Interstate 20 crosses the lower section of WRPA 6 and United States Routes 80, 65, 82, 84, and major State highways provide additional access. Numerous transport carriers provide service throughout the area.

Airlines

Scheduled airline service is not available in WRPA 6. There are a number of small airports in the major urban areas which provide local service.

Pipelines

Natural gas and crude oil pipelines cross the area from the southwest to the northeast. All of these lines originate in East Texas and the Louisiana coastal area.

EXISTING NAVIGATION IMPROVEMENTS

Shallow-Draft Channels

There are no active navigation projects in WRPA 6. In the late twenties and mid-thirties, three streams were improved for navigation (see table 46). However, except for limited use by commercial fishermen and small pleasure craft, little navigation exists on any of the waterways in the area. Navigation improvements consisted of clearing and snagging.

Table 46 - Navigation Projects, WRPA 6

<u>Stream</u>	<u>Limits of Project Mile to Mile</u>		<u>Head of Navigation</u>	<u>Last year of Project Maintenance</u>
Tensas River, La.	0	137.8	Tendal, La.	1935
Bayou Macon, La.	0	111.6	Floyd Landing	1929
Boeuf River, La.	0	166.0	Wallace Landing	1935

Deep-Draft Channels

No deep-draft channels exist in WRPA 6.

Locks

There are no locking facilities on streams within WRPA 6.

Ports

Shallow Draft

Lake Providence Harbor. Existing port and harbor improvements, located 3 miles south of Lake Providence, La., were authorized under provisions of the River and Harbor Act of 1960. Improvements included dredging of a harbor channel and turning basin in the lower part of Hagaman Chute (an old bendway channel) on the Mississippi River. The harbor channel is 0.7 mile in length, 150 feet wide, and has a project depth of 9 feet. The old channel was widened to 400 feet in front (and upstream) of the port area for a distance of about 800 feet to provide for the turning basin. Local interests were required to construct retaining dikes to provide a disposal area for excavation material from the harbor improvements. The resulting fill area provides space for the existing port structures and equipment (public and private). Major commodities handled by the port include: grain, lime, and sand and gravel. In 1970, total tonnage handled amounted to approximately 446,800 tons.

Other port facilities. In WRPA 6, there are 19 private port facilities located on the Mississippi River between Vidalia, La., and DeSoto Landing, Ark. In Louisiana, private facilities are located at or near Vidalia, Canebrake, Newellton, Delta, Omega, Alsatia, and Lake

Providence. Facilities in Arkansas are located near Eudora, Lake Village, Arkansas City, and at DeSoto Landing. Principal commodities handled include: grains (47 percent of the total number of private ports handle grains), petroleum products, and sand and gravel. Two of the facilities (mat casting used for river revetment work) are operated by the Corps of Engineers. One private facility provides barge service for waterborne commerce on the river.

Deep Draft

There are no deep-draft ports in WRPA 6.

Summary of Existing Navigation Improvements

A summary of existing navigation improvements is shown in table 47.

Table 47 - Existing Navigation Improvements, WRPA 6

<u>Ports</u>	<u>Depth</u> feet	<u>Width</u> feet	<u>Length</u> miles	<u>Remarks</u>
Lake Providence	9	150	0.7	Turning basin 400' x 800'

AUTHORIZED NAVIGATION IMPROVEMENTS

There are no authorized navigation improvements in WRPA 6.

EXISTING COMMERCE

General

In WRPA 6, there are approximately 310 miles of Mississippi River bank. In this distance, there are numerous private terminals and one public terminal, Lake Providence, La. A total of 2.3 million tons was handled in WRPA 6 in 1970. A summary of existing commerce by commodity type is presented in table 48.

Inland Commerce

Lake Providence

In 1970, Lake Providence moved 446,800 tons which accounted for 19 percent of the waterborne commerce moved. Forty-seven percent of the commerce at Lake Providence was grain. Corn was shipped in from the

upper Mississippi area and soybeans were shipped out to New Orleans. Forty-four percent was composed of CSSA in the form of local sand and gravel. Eight percent, classified as other, was lime brought to the public terminal. The remaining 1 percent included small shipments of iron and steel, industrial chemicals, wood and paper, and general cargo.

Private Terminals

Total private terminal shipments in WRPA 6 were 1.9 million tons in 1970. This was 81 percent of the total shipments. Accounting for the most tons moved was petroleum with 56 percent; next was CSSA, 23 percent; grain, 16 percent; and wood and paper, 4 percent. The remaining 1 percent included industrial chemicals, other and general cargo.

Coastwise and Foreign Trade

There were no foreign or coastwise traffic reported in WRPA 6 in 1970.

VESSEL COMPOSITION

No vessel composition is shown for WRPA 6 since it is included in the vessel composition analysis of WRPA 1.

FUTURE NEEDS

Prospective Commerce

General

Waterborne commerce in the selected commodity categories was projected in accordance with indices of output developed for the appropriate major industry groups. These indices are shown on table 49. In general, the Program A indices represent OBERS' forecast of economic growth for the individual WRPA's within the Lower Mississippi Region. Program B indices were developed to reflect a regional growth in employment equal to the national average, 1.4 percent^{1/}. Application of these indices to the base year tonnages shown previously on table 48 yield future levels of commerce as shown in aggregate on table 50. These levels are designated as the gross needs of the area. Note that the projections are expressed in ton-miles for the waterways and in short tons for the ports.

^{1/} Further discussion of these indices and their derivations is contained in Appendix B, Economics.

Table 48 - 1970 Waterborne Commerce, WRPA 6

Waterway or Port	Inland Traffic (Thousand Short Tons)						Total
	Grain	Petroleum	CSSA	Iron & Steel	Industrial Chemicals	Wood & Paper	General Cargo
Mississippi River Ports and Harbors							
Lake Providence	208.4	-	195.7	2.2	1.2	2.4	3.6
Private Terminals ^{1/}	299.7	1,061.4	433.2	-	1.4	79.5	6.5
Total Commerce WRPA 6	508.1	1,061.4	628.9	2.2	2.6	81.9	10.1
							2,330.0

^{1/} Private Terminals are those mentioned in the Existing Navigation Improvements Section plus other small landing sites.

Inland Traffic

Only inland traffic is projected for WRPA 6. Lake Providence Harbor is projected to grow at an average annual growth rate of 2 percent. The private terminals are projected to grow at an average annual growth rate of 2.3 percent.

The installation of two new public terminals by 1980 will increase the tons 14 percent in WRPA 6 in 1980, 15 percent in 2000, and 13 percent in 2020.

Foreign Traffic

No foreign traffic is projected in WRPA 6. It is possible, however, that with the introduction and apparent success of the LASH barges and mini-ships in this area (on the opposite side of the river) that WRPA 6 could begin to have direct foreign shipments.

Total Projected Commerce

Total projected commerce for WRPA 6 is projected to be 3.6 million tons, 4.7 million tons, and 8.2 million tons in 1980, 2000, and 2020, respectively. This is an annual growth rate of 2.5 percent for Program A.

Program B tons were derived as a multiple of Program A tons and factors developed in the Economic Appendix. They are 9.6 percent, 15.7 percent, and 17.9 percent greater than Program A in 1980, 2000, and 2020, respectively.

Net Needs

General

Navigation needs data are shown in table 51 for Programs A and B. The table includes the gross needs for each projected time period, the needs to be satisfied by projects assumed to be complete for each projected time period, and the net needs which are the needs that will require some type of navigation construction to satisfy. The various type navigation improvements are also shown.

Shallow- and Deep-Draft Channels

There are no navigation needs presently estimated in WRPA 6 that would require shallow- or deep-draft channel type construction work.

Locks

There are no navigation needs presently estimated in WRPA 6 that would require lock construction.

Ports and Harbors

A need for port and harbor development exists in WRPA 6. Slack-water inland harbors located off river mainstems are needed to provide areas for loading and unloading facilities and also fleeting areas. The

Table 49 - Economic Forecast, WRPA 6
Index of Productivity by Major Industries

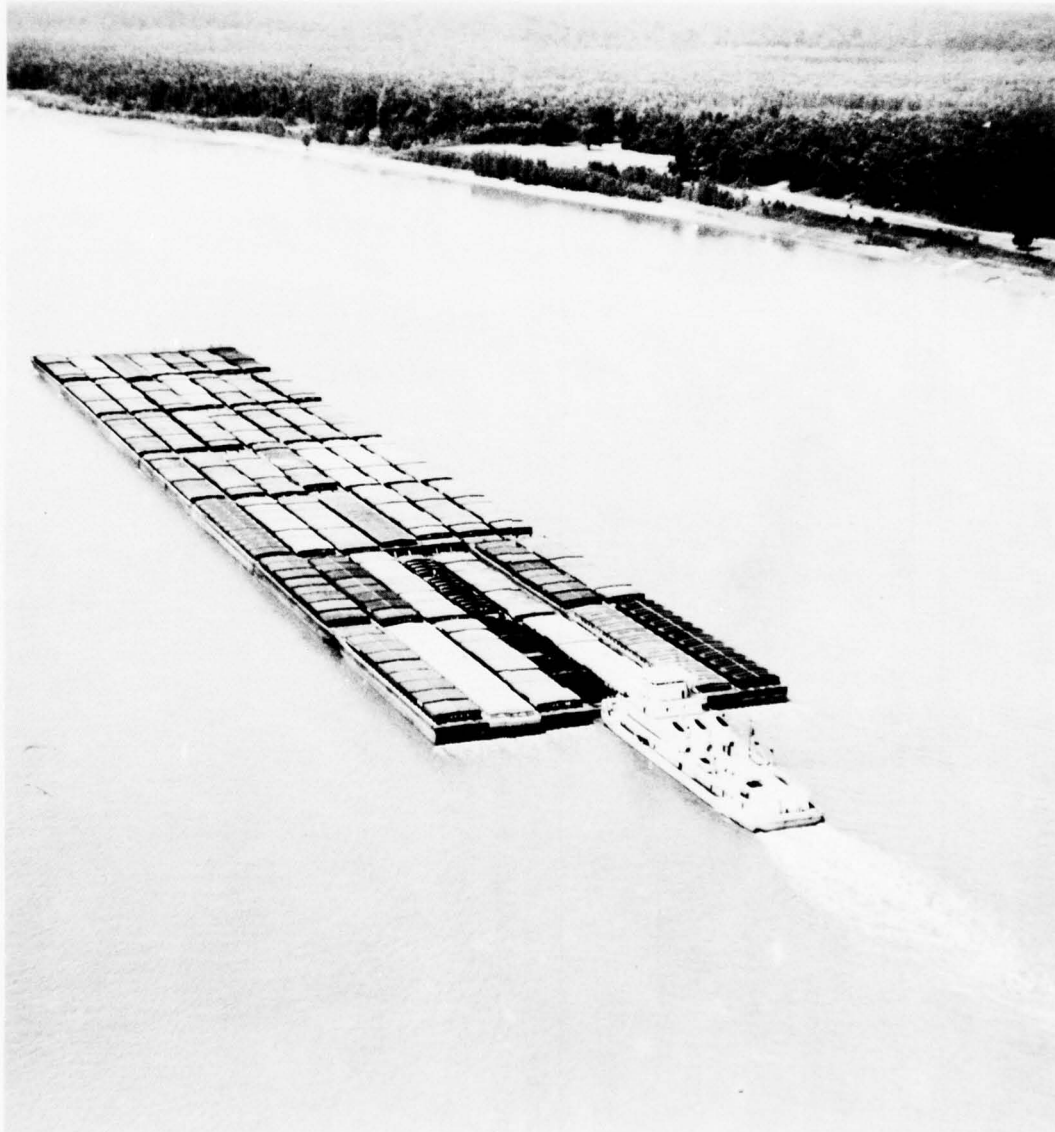
Commodity (Industry Group)	Program	1967	1968	1970	1980	2000	2020
Grain (Agriculture)	A			100	170	197	233
	B				170	212	250
Coal (National Coal Growth Rate)	A	100	104	109	143	199	323
	B				157	230	381
Petroleum (Mining and Refining, Average)	A	100	116	122	154	232	388
	B				169	268	458
CSSA (Quarrying)	A	100	102	105	121	120	160
	B				133	139	189
Sulphur (Held Constant)	A	100	100	100	100	100	100
	B				100	100	100
Iron and Steel (National I & S Growth Rate)	A	100	103	109	141	218	340
	B				155	252	401
Industrial Chemicals (Chemical and Allied Products)	A	100	114	131	218	602	1,519
	B				239	696	1,792
Agricultural Chemicals (Agriculture)	A			100	170	197	233
	B				170	212	250
Aluminum (Primary Metals)	A	100	103	109	141	218	340
	B				155	252	401
Wood and Paper (Forestry)	A			100	93	129	139
	B				98	140	187
Other (Chemical and Allied Products)	A	100	114	131	218	602	1,519
	B				239	696	1,792
General Cargo (Other Manufacturing)	A	100	100	111	168	372	805
	B				185	430	949

Table 50 - Present and Prospective Waterborne Commerce, WSPA 6
Shallow Draft
(Thousand Short Tons)

Waterway or Port	1970 Commerce	Program A		Program B	
		1980	2000	1980	2000
Mississippi River Ports and Harbors					
Lake Providence	446.8	647.1	811.8	709.5	938.9
Desha County	-	250.0	309.0	274.1	357.4
Tensas Parish	-	250.0	309.0	274.1	357.4
Private Terminals ^{1/}	1,913.8	2,467.0	3,274.7	2,704.7	3,787.4
TOTAL	2,360.6	3,614.1	4,704.5	3,962.4	5,441.1
			8,198.6		9,669.8
					1,438.1
					599.2
					599.2
					7,033.3

^{1/} Private Terminals are those mentioned in the Existing Navigation Improvements Section plus other small landing sites.

spoil from harbor construction will likely be used for industrial fill. The net needs are shown in table 51 for Programs A and B, and were assumed to be equal to the total projected tonnage less the tonnage presently handled by existing facilities. No attempt was made to determine capacity of the existing facilities. Net needs for Program A for 1980, 2000, and 2020 are 1,253,500, 2,343,900, and 5,838,000 tons, respectively. Program B needs were calculated similar to Program A projected commerce.



Forty-nine barge tow upbound on the Mississippi River.

Table 51 - Navigation Needs, WRP A 6

Item	Program A		Program B	
	1970	1980 2000	1980 2000	2020
Deep-draft Channels (10 ⁶ Ton-Miles)				
New Channels				
Gross Need		NONE	NONE	
Existing Supply				
Net Need				
Existing Facilities Improvement				
Gross Need				
Existing Supply		NONE	NONE	
Net Need				
Shallow-draft Channels (10 ⁶ Ton-Miles)				
New Channels				
Gross Need		NONE	NONE	
Existing Supply				
Net Need				
Existing Facilities Improvement				
Gross Need				
Existing Supply		NONE	NONE	
Net Need				
Deep-draft Navigation Locks (# Ship Lockages)				
Gross Need		NONE	NONE	
Existing Supply				
Net Need				
Shallow-draft Navigation Locks (10 ³ Tons)				
Gross Need		NONE	NONE	
Existing Supply				
Net Need				

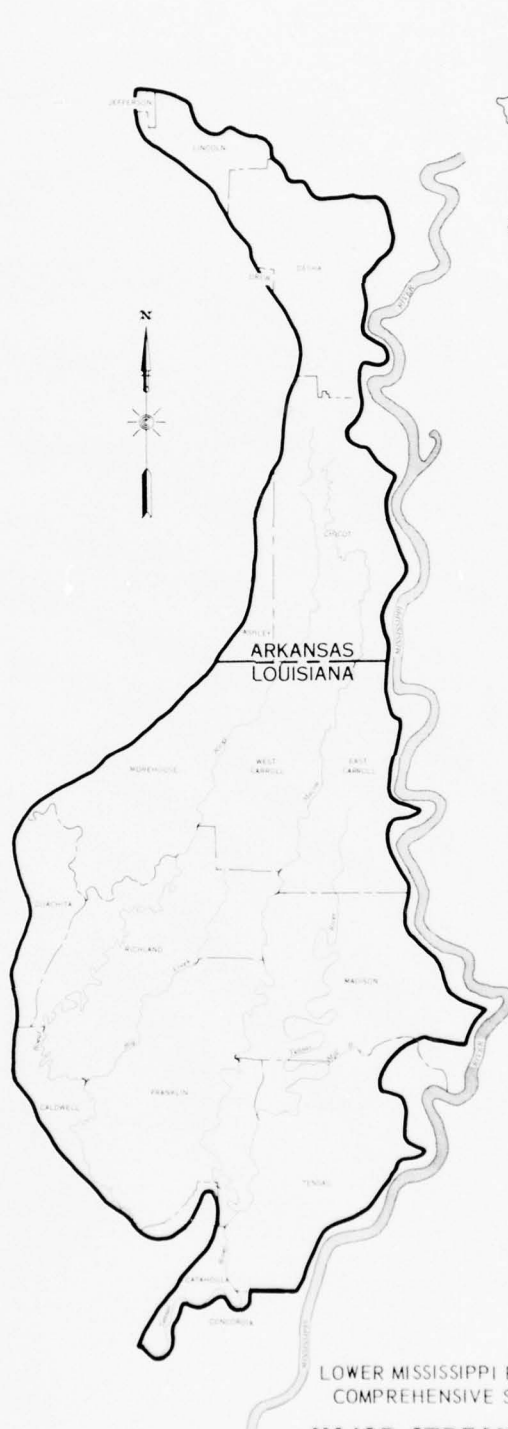
Table 51 - Navigation Needs, WRP 6 (cont.)

Item	1970	Program A		Program B	
		1980	2000	1980	2000
Deep-draft Harbors and Ports (10 ³ Tons)					
Gross Need					
Existing Supply					
Net Need					
			NONE		NONE
Shallow-draft Harbors and Ports (10 ³ Tons)					
Gross Need	2,360.6	3,614.1	4,704.5	3,962.4	5,441.1
Existing Supply	2,360.6	2,360.6	2,360.6	2,360.6	2,360.6
Net Need	0	1,253.5	2,343.9	1,601.8	3,080.5
			5,838.0		7,309.2



LEGEND

- HYDROLOGICAL BOUNDARY
- STATE BOUNDARY
- PARISH OR COUNTY BOUNDARY



LOWER MISSISSIPPI REGION
COMPREHENSIVE STUDY
**MAJOR STREAMS AND
NAVIGABLE WATERWAYS**
WRPA-6

FIGURE 7

W R P A 7

GENERAL DESCRIPTION

All or part of 17 counties in central and southwestern Mississippi--which are within or adjacent to the Big Black, Homochitto, and Buffalo Rivers, and Bayou Pierre drainage basins--comprise WRPA 7.

The Big Black River Basin is 155 miles in length and averages about 22 miles in width, constituting a long narrow basin with a drainage area of 3,300 square miles. The terrain and configuration of the basin is such that no appreciable amount of the total drainage area is controlled by any single tributary. Numerous small tributaries, few of which are over 20 miles in length, thoroughly dissect both the eastern and western margins of the basin. These tributaries have their source in the hill sections and carry a rapid runoff from drainage areas which vary considerably in size.

The southwest Mississippi drainage basin contains three major streams--the Buffalo and Homochitto Rivers, and Bayou Pierre. Topographical characteristics of this area are similar to the Big Black Basin. The southwest basin is bounded on the north by the Big Black Basin, on the east and south by the Pearl River Basin, and on the west by the Mississippi River. Most of the drainage originates from the "hill area," with small strips of flat land along the Mississippi which are mostly swamp areas. Other minor tributaries in the basin are Washout Bayou, St. Catherine Creek, Cotes Creek, and Dowd Creek.

Water Resource Planning Area 7 experiences a mild climate with an average annual temperature of 65° F. Freeze-free period (growing season) average 270 days. Rainfall throughout the area is heavy, ranging from 55 to 60 inches annually and occurs mostly during the spring months.

Existing Economic Development

Total employment in the area was approximately 58,000 in 1968. This number represented an increase of 15 percent over the number reported in 1959. Earnings for all area industries in 1968 were \$246 million. Paper and allied products, agricultural activities, civilian government, retail and wholesale trade, services, and food and kindred products are principal industries of this WRPA and provide the major source of income. Earnings contributed by major industry groups include: agriculture (includes forestry, fisheries, and mining), 18 percent of total; manufacturing, 33 percent; and other industries, 49 percent. Principal contributors in manufacturing are: paper and allied products, 6 percent of total earnings; and food and kindred products, 2 percent.

Valuable agricultural lands are the principal resource and has been basic to the area's economic development. Agriculture continues to be a major segment of the economy. Ninety-four percent of the total land and water area in WRPA 7 is in agricultural use. Fifty-eight percent of the land in agricultural use is in farms and 42 percent is in forests. Timber resources have been largely responsible for industrial growth, particularly in the southwest portion of the WRPA. The Homochitto National Forest occupies a large portion of the southwest area. Non-agricultural use, which consists of Federally owned lands, urban and built-up areas, and small water areas account for 5 percent of the total area. Large water areas constitute the remaining 1 percent of the total.

Transportation Facilities (Excluding Waterways)

Railroads

Two major railways (Illinois Central and Frisco) provide freight transportation into and out of WRPA 7. With the railway service available, shipments or receipts of cargo can be made from adjoining states and other points in the Nation.

Highways

A network of numerous interstate, Federal, State, and other roads provide transportation to any area within and outside the WRPA. Numerous truck lines provide common, contract, and specialized transport.

Airlines

Scheduled airline service in the Big Black WRPA is limited. Natchez, Miss., (in the southwest drainage basin) is the only location within the area where scheduled air transportation and freight service is available. Southern Airlines provides this service for Natchez.

Pipelines

Natural gas lines cross WRPA 7 from the southwest to the northeast and in an east-west direction near the center of the area. These lines originate in east Texas and the Louisiana coastal regions.

EXISTING NAVIGATION IMPROVEMENTS

Shallow-Draft Channels

There are no active navigation projects in WRPA 7. However, in 1881, a project was adopted which provided for high-water navigation to Cox's Ferry on the Big Black River (mile 102) by removal of wrecks, snags, etc., from the channel. Snagging operations were begun in 1884 and suspended in 1894, pending removal of low, fixed bridges. Local interests decided the bridges were of more value than navigation and the navigation improvements were discontinued.

Deep-Draft Channels

No deep-draft channels exist in WRPA 7.

Locks

There are no navigation locks in WRPA 7.

Ports

Shallow Draft

Local interests at Natchez, Miss., have constructed a port facility just south of Natchez on the 9-foot deep Mississippi River channel. This port provides public terminal facilities for shippers of waterborne commerce in the area. The Corps of Engineers has constructed a levee with floodgate and pumping plant to provide protection for the Natchez Port Area from the Mississippi River project flood. The Natchez Port Area project was authorized under Section 205 of the Flood Control Act of 30 June 1948--construction was completed in 1968.

Major commodities currently handled by the public terminal and private facilities at Natchez consist of agricultural products (grain), construction materials, and wood and paper products. In 1970, waterborne commerce shipments reported for the Natchez area amounted to 487,600 tons.

Deep Draft

There are no deep-draft ports in WRPA 7.

AUTHORIZED NAVIGATION IMPROVEMENTS

There are no authorized navigation improvements in WRPA 7.

EXISTING COMMERCE

General

Waterborne commerce in WRPA 7 consisted solely of traffic moving on the Mississippi River either destined for or originating at Natchez, Miss., the only major port. The rest of the ports are small private terminals. In WRPA 7, there are approximately 115 miles of Mississippi River bank.

A summary of existing commerce for WRPA 7 is presented in table 52. Total tons handled in 1970 were 846,500 tons. Sixty-nine percent of the tonnage was composed of CSSA; 20 percent, wood and paper; and 6 percent,

grain. The remaining 5 percent is composed of petroleum, iron and steel, industrial chemicals, "other" and general cargo.

Natchez, Mississippi

A total of 489,200 tons were handled in Natchez in 1970. The Natchez Public Terminal handled 168,379 tons or 34 percent of the total Natchez, Miss., tonnage. The public terminal is located on the Mississippi River without protection of a harbor. Of this total, 487,600 tons were inland and 1,600 tons were foreign traffic. Natchez, Miss., moved 58 percent of the tons handled in WRPA 7.

Inland traffic for Natchez, Miss., was primarily CSSA and wood and paper with 239,000 and 159,900 tons, respectively. These two commodities comprise 82 percent of the total traffic. The remaining 18 percent consists of the following minor commodity groups: grain, petroleum, iron and steel, industrial chemicals, and general cargo. CSSA (concrete, sand, shells, aggregates, and waterway improvement materials) commodities were shipped from various points along the Mississippi River. Movements of wood and paper were from local pickup points along the Mississippi River, while grain shipments (primarily corn) originated in the Upper Mississippi Region. Foreign traffic was composed totally of shipments of wood and paper.

Private Terminals

A total of 357,300 tons were handled by private terminals in WRPA 7. Ninety-six percent of these tons were CSSA, 3 percent wood and paper, and less than 1 percent "other."

No foreign traffic was reported for the private terminals.

VESSEL COMPOSITION

No vessel composition is shown for WRPA 7 since it is included in the vessel composition analysis of WRPA 1.

Table 52 - 1970 Waterborne Commerce, WRPA 7
(Thousand Short Tons)

Waterway or Port	Grain	Petroleum	COSA	Iron & Industrial		Wood & Paper	Other	General Cargo	Total
				Steel	Chemicals				
<u>Inland Traffic</u>									
Mississippi River Ports and Harbors									
Natchez	54.7	1.9	239.0	27.6	2.7	159.9	-	1.8	487.6
Private Terminals-1/	-	-	343.9	-	-	11.9	1.5	-	357.5
<u>Foreign Traffic</u>									
Mississippi River Ports and Harbors									
Natchez	-	-	-	-	-	1.6	-	-	1.6
Total Commerce-WRPA 7	54.7	1.9	582.9	27.6	2.7	173.4	1.5	1.8	846.5

^{1/} private Terminals are those mentioned in the Existing Navigation Improvements Section plus other small landing sites.

FUTURE NEEDS

Prospective Commerce

General

Waterborne commerce in the selected commodity categories was projected in accordance with indices of output developed for the appropriate major industry groups. These indices are shown on table 53. In general, the Program A indices represent OBERS' forecast of economic growth for the individual WRPA's within the Lower Mississippi Region. Program B indices were developed to reflect a regional growth in employment equal to the national average, 1.4 percent^{1/}. Application of these indices to the base year tonnages shown previously on table 52. yield future levels of commerce as shown in aggregate on table 54. These levels are designated as the gross needs of the area. Note that the projections are expressed in ton-miles for the waterways and in short tons for the ports.

Natchez, Mississippi

Program A prospective commerce for Natchez, Mississippi, in 1980, 2000, and 2020 is 1.3 million tons, 4.4 million tons, and 5.7 million tons, respectively. This represents an average annual compound growth rate of 5.0 percent between 1970-2020.

The foreign traffic projected for Natchez, Mississippi, is 4,200 tons in 1980, 14,300 tons in 2000, and 18,600 tons in 2020. The base year projection figure consisted of one mini-ship load of logs. It is felt that these projections of direct foreign tonnage are understated because of more frequent movement by LASH barges and mini-ships since 1970.

Private Terminals

The projected private terminal tonnage is 480,100 tons, 870,000 tons, and 1,632,400 tons for 1980, 2000, and 2020, respectively. This is an average annual compound growth rate of 3.1 percent between 1970-2020.

Summary of Prospective Commerce

The total prospective waterborne commerce for WRPA 7 is summarized in table 54. Program A projections for 1980, 2000, and 2020 are 1.8 million tons, 5.2 million tons, and 7.3 million tons, respectively. The total tonnage average annual growth rate is 4.4 percent.

Program B tonnages were derived as a multiple of Program A tonnages and factors developed in the Economics Appendix. They are 9.6 percent, 15.7 percent, and 17.9 percent greater than Program A in 1980, 2000, and 2020, respectively.

^{1/} Further discussion of these indices and their derivations is contained in Appendix B, Economics.

Table 53 - Economic Forecast, WRPA 7
Index of Productivity by Major Industries

Commodity (Industry Group)	Program	1967	1968	1970	1980	2000	2020
Grain (Soybeans)	A			100	194	239	280
	B				194	256	300
Coal (National Coal Growth Rate)	A	100	104	109	143	199	323
	B				157	230	381
Petroleum (Mining and Refining, Average)	A	100	126	134	176	338	709
	B				194	392	836
CSSA (Quarrying)	A	100	102	110	149	272	512
	B				163	315	604
Sulphur (Held Constant)	A	100	100	100	100	100	100
	B				100	100	100
Iron and Steel (National I & S Growth Rate)	A	100	114	109	141	218	340
	B				155	252	401
Industrial Chemicals (Chemical and Allied Products)	A	100	99	113	182	424	965
	B				200	490	1,138
Agricultural Chemicals (Agriculture)	A			100	147	182	221
	B				147	196	237
Aluminum (Primary Metals)	A	100	103	109	141	218	340
	B				155	252	401
Wood and Paper (Forestry)	A			100	84	126	143
	B				110	158	190
Other (Chemical and Allied Products)	A	100	99	113	182	424	965
	B				200	490	1,138
General Cargo (Other Manufacturing)	A	100	107	122	195	463	1,047
	B				214	536	1,235

Table 54 - Present and Prospective Waterborne Commerce, WSPA 7
(Thousand Short Tons)

<u>Waterway or Port</u>	<u>1970 Commerce</u>	<u>Program A</u>		<u>Program B</u>	
		<u>1980</u>	<u>2000</u>	<u>1980</u>	<u>2020</u>
		<u>Shallow Draft</u>			
Natchez, Mississippi	487.6	1,279.4	4,356.9	1,402.7	5,039.0
Private Terminals ^{1/}	357.3	480.1	870.0	526.4	1,006.2
					1,925.3
		<u>Foreign Traffic</u>			
Natchez, Mississippi	1.6	4.2	14.3	4.5	16.5
TOTAL	846.5	1,763.7	5,241.2	1,933.7	8,617.2

^{1/} Private Terminals are those mentioned in the Existing Navigation Improvements Section plus other small landing sites.

Net Needs

General

Navigation needs data are shown in table 55 for Programs A and B. The table includes the gross needs for each projected time period, the needs to be satisfied by projects assumed to be completed for each projected time period, and the net needs which are the needs that will require some type of navigation construction work to satisfy. The various type navigation improvements are also shown.

Shallow- and Deep-Draft Channels

There are no navigation needs presently estimated in WRPA 7 that would require shallow- or deep-draft channel type construction work.

Locks

There are no navigation needs in WRPA 7 that would require lock construction.

Ports and Harbors

A need for port and harbor development exists in WRPA 7. A slack-water inland harbor located off the Mississippi River main channel is needed to provide area for public port terminal facilities and also fleeting areas. The spoil from harbor construction will likely be used for industrial fill. The net needs are shown in Table 55 for Programs A and B, and were assumed to be equal to the total projected tonnage less the tonnage presently handled by existing facilities. No attempt was made to determine capacity of the existing facilities. Net needs for Program A for 1980, 2000, and 2020 are 917,300 tons, 4,394,700 tons, and 6,459,700 tons, respectively. Program B needs were derived as a multiple of Program A needs and factors developed in the Economics Appendix. They are 9.6 percent, 15.7 percent, and 17.9 percent greater than Program A in 1980, 2000, and 2020, respectively.

Table 55 - Navigation Needs, WSPA 7

Item	Program A		Program B	
	1970	1980 2000 2020	1980	2000 2020
Deep-draft Channels (10 ⁶ Ton-Miles)				
New Channels				
Gross Need		NONE		NONE
Existing Supply				
Net Need				
Existing Facilities Improvement				
Gross Need				
Existing Supply		NONE		NONE
Net Need				
Shallow-draft Channels (10 ⁶ Ton-Miles)				
New Channels				
Gross Need		NONE		NONE
Existing Supply				
Net Need				
Existing Facilities Improvement				
Gross Need				
Existing Supply		NONE		NONE
Net Need				
Deep-draft Navigation				
Gross Need				
Existing Supply		NONE		NONE
Net Need				
Shallow-draft Navigation Locks (10 ³ Tons)				
Gross Need				
Existing Supply		NONE		NONE
Net Need				

Table 55 - Navigation Needs, WSPA 7 (cont.)

Item	1970	Program A		Program B	
		1980	2020	1980	2020
Deep-draft Harbors and Ports (10 ³ Tons)					
Gross Need					
Existing Supply					
Net Need				NONE	
Shallow-draft Harbors and Ports (10 ³ Tons)					
Gross Need	846.5	1,763.8	5,241.2	1,933.9	6,061.8
Existing Supply	846.5	846.5	846.5	846.5	846.5
Net Need	0	917.3	4,394.7	1,087.4	5,215.3
					7,770.7



W R P A 8

GENERAL DESCRIPTION

WRPA 8 is comprised of all or parts of 13 east-central Louisiana parishes and five south-western Mississippi counties. Total land area is 5,705 square miles, which is 6 percent of the study area. About 12 percent of the WRPA 8 land area lies west of the Mississippi River. Half of the WRPA is in the alluvial plain of that river, while the north-eastern third is comprised of gently rolling hills. Over 60 percent of WRPA 8 consists of forested areas with the remainder made up of pasture and cropland (20 percent), and other lands (20 percent).

The warm waters of the Gulf of Mexico and the prevailing southerly winds combine to provide a generally mild climate with temperatures seldom rising above 95° F. or falling below 40° F. year round. Annual rainfall averages about 60 inches.

Existing Economic Development

The two economic factors of prime importance to WRPA 8 are the petrochemical and basic metals industries located in the Baton Rouge area and along the Mississippi River, and, secondarily, agricultural and timber production which are generally confined to the north-eastern two-thirds of the area.

Natural resources of importance found in WRPA 8 include crude petroleum, natural gas, sand and gravel, salt, and commercial forests. WRPA 8 contains or has immediate access to adequate ground and surface water resources. Most important to the area is the Mississippi River (WRPA 1) which provides a large supply of fresh water to the industries along its banks as well as a deep-draft navigational outlet to the Gulf of Mexico.

The population of WRPA 8 has grown from 297,755 in 1940 to 546,984 in 1970, an increase of over 83 percent. During this same period, urban population increased from 20 percent to about 58 percent of the total, most of which can be credited to East Baton Rouge Parish. This parish, which contains the City of Baton Rouge, increased from 88,415 persons in 1940 to 285,167 in 1970.

Transportation Facilities (Excluding Waterways)

Railways

Railway service in WRPA 8 is provided by four lines, the Illinois Central Railroad, the Missouri Pacific Railroad Company, the Louisiana

and Arkansas Railway Company, and the Texas and Pacific Railway Company. All except the Texas and Pacific pass through Baton Rouge.

Highways

WRPA 8 is served by numerous local, state, and Federal roads and highways. Major among these are U. S. Highways 51, 61, and 190, and Interstate Highways 10, 12, and 55. All pass through or near Baton Rouge, except U. S. 51 and I-55, which are closely parallel and run North-South through Hammond, Louisiana, and McComb, Mississippi.

Airlines

Major commercial air service in WRPA 8 is limited to one facility located in the City of Baton Rouge. This field is equipped to handle passenger and freight aircraft up to and including the smaller jets.

Pipelines

Several oil and gas pipelines originate in the portion of WRPA 8 west of the Mississippi River. A far greater number of lines traverse the area, generally bound for the North and Northeastern areas of the United States. These major lines range in diameter from about 10 inches to 36 inches.

EXISTING NAVIGATION IMPROVEMENTS

General

Table 56 lists all existing navigation facilities within WRPA 8. Detailed information may be found in Appendix D, Inventory of Facilities.

Shallow-Draft Channels

The GIWW, Morgan City to Port Allen Alternate Route, Baton Rouge Harbor Barge Channel, and Big and Little Pigeon Bayous are the only commercially significant channels within WRPA 8. The remaining channels in this WRPA east of the Mississippi River, although reporting little or no barge traffic, are heavily utilized by recreational craft and, together with Lake Maurepas and the connecting Lake Pontchartrain located in WRPA 10, provide most of WRPA 8 with many areas suited to any water sport. Bayou Grosse Tete, located west of the Mississippi River, affords both recreational and commercial fishing.

Ports

The Port of Baton Rouge, Louisiana, which ranks seventh in the United States (1970), is the only major port located in WRPA 8. It comprises both banks of the Mississippi River from about Mile 168.3

above Head of Passes to about Mile 255.2 above Head of Passes, and includes the Baton Rouge Harbor (Devil's Swamp) Barge Channel.

The port is at the southern terminus of the existing 9-foot channel (12-foot authorized) and at the head of the deep-draft channel of the Mississippi River. The port is also served by a direct connection with the Gulf Intracoastal Waterway via the Port Allen Lock and the Gulf Intracoastal Waterway Alternate Route which extends from Morgan City, Louisiana to Port Allen, Louisiana.

Fifty-two piers, wharves, and docks are located in the Port of Baton Rouge. Thirty-two of these waterfront facilities are on the left bank, 17 are on the right bank of the Mississippi River, extending from about Mile 169.3 to Mile 234.3 above Head of Passes, and three are on the Baton Rouge Harbor (Devil's Swamp) Barge Channel.

Table 57 summarizes the piers, wharves, and docks at the port by primary purpose for which used or type of service offered.

Four companies operate warehouses in the port area with a total capacity of 629,000 square feet of dry storage space. These warehouses are used for storing general merchandise, have railroad connections, and are easily accessible to arterial highways. Diversified handling equipment is maintained by the operators, and special services are provided including packing and crating, forwarding, pool car distribution, car-loading, weighing, stamping, and marking. In addition, the Greater Baton Rouge Port Commission has open areas which are available for storage of waterborne cargo not requiring protection from the weather.

WRPA 8 also contains several small ports which have legally constituted harbor and terminal authorities. These ports are listed in the Regional Summary.

Barge Locks

Port Allen and Bayou Sorrel Locks are both located on the Morgan City to Port Allen Alternate Route. The Port Allen Lock serves as the connection to the Mississippi River while Bayou Sorrel Lock permits navigation through the East Atchafalaya Basin Protection Levee.

Navigation Aids

The U. S. Coast Guard maintains all necessary navigation aids on Federally constructed channels and harbors, and marks hazards to navigation.

Table 56 - Existing Navigation Improvements^{1/}, WRPA 8

Shallow-Draft Channels	Depth feet	Width feet	Length miles	Remarks/Section Included ^{2/}
Amite River and Bayou Manchac, La.	7	60	44	Lake Maurepas to Louisiana & Arkansas, RR Bridge at Mi. 8 of Bayou Manchac. Channel dimension apply only to Miles 0-31 with snagging for remainder of project length.
Baton Rouge Harbor (Devil's Swamp)	12	300	2.5	From Mississippi River @ Mile 234 AHP generally northward for 2.5 miles, an additional 2.5 miles is authorized to be constructed when port development warrants.
Bayou Grosse Tete, La.	5	60	10.3	Original project from Indian Village, La., to Mi. 10.3, Mi. 0 to Mi. 2 is now part of Morgan City-Port Allen Alternate Route.
	5	40	18.7	From Mi. 10.3 of Bayou Grosse Tete to Mi. 29.
Big Pigeon and Little Pigeon Bayous, La.	--	--	27	Project provided for removal of obstructions from the entire length of both bayous.
Gulf Intracoastal Waterway-Morgan City to Port Allen Alternate Route	12	125	64.1	From GIWW Mi. 95.5 WHL to Mississippi River Mi. 227.6 AHP.
Pass Manchac, La.	--	--	7	From Lake Maurepas to Lake Pontchartrain, Project provides for removal of snags and logs only.
Tangipahoa River, La.	8	100	53.5	From Mouth to Mi. 53.5. Channel dimensions apply to bar channel only. Remainder of project provides only for removal of snags and obstructions.
Tickfaw, Natalbany, Pontchatoula, and Blood River, La.	--	--	45.5	Project provides for the removal of obstructions in the Tickfaw River, Mi. 0 to 26 in the Natalbany River from Mi. 0 to 10, in the Pontchatoula River from Mi. 0 to 5.5, and in the Blood River from Mi. 0 to 4.

^{1/} Detailed information on existing facilities may be found in Appendix D, Inventory of Facilities.

^{2/} Points on Mississippi River are expressed as miles above the Head of Passes (AHP); Points on the GIWW are expressed as miles east or west of Harvey Lock in New Orleans (EHL, WHL).

Table 56 - Existing Navigation Improvements^{1/}, WRPA 8 (cont'd)

<u>Ports</u>	<u>Depth</u> <u>feet</u>	<u>Width</u> <u>feet</u>	<u>Length</u> <u>miles</u>	<u>Remarks/Section Included</u> ^{2/}
Port of Baton Rouge	40	500	65	Both banks of Mississippi River from Mi. 168 AHP to Mi. 233 AHP
	12	300	20	Both banks of Mississippi River from Mi. 233 AHP to 253 AHP. Also includes 2.5-mile barge canal [Baton Rouge Harbor (Devil's Swamp)]. Detailed information can be found in Appendix V, Inventory of Facilities.
<u>Locks</u>	<u>Width</u> <u>feet</u>	<u>Length</u> <u>feet</u>	<u>Depth over Sill</u> <u>feet</u>	<u>Remarks/Section Included</u> ^{2/}
Bayou Sorrel Lock	56	797	14	Opened to Navigation 1952
Port Allen Lock	84	1,202	13.75	Opened to Navigation 1961



Baton Rouge Harbor.

Table 57 - Port of Baton Rouge Facilities

<u>Primary Purpose for which Used</u>	<u>Number</u>
Cargo handling:	
Bauxite and alumina	3
Bulk salt, chlorine, and liquid caustic soda	1
General cargo:	
By barge	1
Foreign and domestic	2
Grain, molasses, benzene, and muriatic acid (one each) . .	4
Liquid ammonia	3
Petroleum products, crude oil, petrochemicals, and Chemicals	14
Phosphate, flourspar, dry and liquid sulphur, liquid fertilizer, ammonia, and chemicals	1
Shell	8
Sulphuric acid and liquid sulphur	2
Landing for passenger and vehicular ferries	4
Marine services and repairs:	
Handling boat stores and marine supplies	2
Mooring	2
Mooring in connection with marine repairs and outfitting.	3
Unused facilities at time of survey	<u>2</u>
TOTAL	52

EXISTING COMMERCE

General

The 1970 waterborne commerce for WRPA 8 is shown by commodity categories in table 58. Petroleum products and Industrial chemicals comprise the majority of movements. In addition, the Port of Baton Rouge handles large amounts of grains, iron and steel, and aluminum ores.

Inland Commerce

Commodity categories involving significant inland tonnages for WRPA 8 are discussed below.

Grain

Waterways within WRPA 8 support little significant inland grain traffic. The Port of Baton Rouge, however, handled shallow-draft tonnages in excess of 2,000,000 tons in 1970. This grain, almost entirely corn and soybeans, is nearly all exported.

Coal

The majority of WRPA 8 movements in this category consist of through tows of coal southbound for Texas on the Morgan City-Port Allen Alternate Route, and import-export tonnages of coke, asphalt, and related solvents handled at the Port of Baton Rouge.

Petroleum and Related Products

Crude petroleum and refined products comprise 44 percent of all waterway movements in WRPA 8 and 45 percent of inland tonnages handled at the Port of Baton Rouge. As shown in table 58, nearly all of the WRPA 8 waterway movements of petroleum originate on the Morgan City-Port Allen Alternate Route. In the main, these movements represent crude oil which is produced within the Atchafalaya Basin and then moved by barge to refineries in the Baton Rouge area and elsewhere, and refined petroleum products moving in through tows from refineries in Texas and Southwest Louisiana to points on the Mississippi River System. About 65 percent of the inland petroleum tonnages handled at Baton Rouge consist of shallow-draft receipts and shipments of crude oil and refined gasoline. The remainder comprises both receipts and shipments of the various other refined oil products.

Iron and Steel

Iron and manganese ores represent the bulk of inland tonnages within this commodity grouping handled at the Port of Baton Rouge. The movements consist generally of foreign ore imports being barged to inland foundries.

Table 58 - 1970 Waterborne Commerce, WRPA 8
(Short tons)

Waterway	Grain	Coal	Petroleum	CSSA ^{3/}	Sulfur	Iron & Industrial Steel	Agricultural Chemicals	Aluminum Ores	Other Cargo	General Cargo	Total
Amite River and Bayou Manchac, La.											
Baton Rouge Harbor (Devil's Swamp)											
Bayou Grosse Tete, La. ^{1/}	--	--	--	1,770	--	--	--	--	--	270	2,040
Big Pigeon and Little Pigeon Bayous, La.	--	--	124,000	430	--	260	90	--	--	460	125,240
Gulf Intracoastal Waterway, Morgan City-Port Allen Route	115,496	323,247	7,316,036	865,015	191,857	724,713	4,453,702	337,341	--	2,133,268	177,259 16,637,934
Pass Manchac, La. ^{2/}	--	--	160	64,860	--	--	--	--	--	--	65,020
Tangipahoa River, La.											
Tickfaw, Natalbany, Pontchatoula, and Blood Rivers, La.											

^{1/} Based on average 1966-1970

^{2/} Based on average 1967-1970

^{3/} Cement, Stone, Sand, and Aggregate

Table 58 - 1970 Waterborne Commerce, WRP 8 (cont'd)
(Short tons)

Ports	Grain	Coal	Petroleum	CSSA ³ /	Sulfur	Iron & Steel	Industrial Chemicals	Agricultural Chemicals	Aluminum Ores	Other	General Cargo	Total
Port of Baton Rouge:												
Inland	2,055,028	87,816	9,862,504	878,285	248,519	1,319,020	3,792,297	715,201	204,806	529,259	2,339,960	22,012,695
Coastwise	17,260	--	8,358,222	--	--	1,991	332,551	749,392	--	13,795	75,875	9,549,086
Imports	--	33,150	140,075	--	--	1,524,972	1,916	25,602	4,275,167	543,622	661,258	7,210,762
Exports	3,337,248	88,998	469,427	--	--	191,124	1,799,211	79,610	--	8,104	789,016	6,762,738
Total	5,389,536	209,964	18,830,228	878,285	248,519	3,037,107	5,930,975	1,569,805	4,479,973	1,094,780	3,866,109	45,535,281

Industrial Chemicals

Waterway movements of industrial chemicals in WRPA 8 consist predominantly of northbound through-tows on the Morgan City-Port Allen Alternate Route. These movements generally originate at the numerous chemical and petrochemical plants located on the Louisiana and Texas Gulf coast, and are destined for points on the upper Mississippi River system or for export.

Inland movements of industrial chemicals pertaining to the Port of Baton Rouge are large shipments originating at the large chemical plants located there.

Other

This category is comprised almost entirely of salt moving in through tows on the Morgan City-Port Allen Alternate Route and destined for points on the upper Mississippi River System.

General Cargo

Inland tonnages of significance under this category are unspecified grain mill products, nonferrous ores, and building cement.

Coastwise Trade

Over 85 percent of 1970 coastwise traffic handled through Baton Rouge port facilities consisted of petroleum shipments. Distillate fuel oil and crude petroleum formed the bulk of these shipments and together comprised nearly 60 percent of all coastwise traffic from this port.

Foreign Trade

The major items of foreign commerce shipped and received at Baton Rouge are grains, iron and steel, industrial chemicals, aluminum ores, and general cargo items. These are discussed below.

Grains

Foreign grain traffic at the port consists entirely of exports of which corn and soybeans account for nearly 95 percent.

Iron and Steel

Eighty-three percent of the foreign trade at Baton Rouge covered by this grouping consists of imported iron and manganese ores destined for shallow draft and rail shipment to inland foundries.

Industrial Chemicals

Exports of unclassified basic chemical products account for 97 percent of the trade under this category.

Aluminum Ores

The 1970 deep-draft movements of aluminum ores were comprised entirely of imported bauxite, amounting to nearly 4.5 million tons. These shipments were destined for three facilities in and around Baton Rouge where bauxite is converted into alumina.

The alumina is then railed and/or barged to primary aluminum facilities in the New Orleans area and elsewhere.

General Cargo

Under this category the dominant articles are imported unclassified non-ferrous ores and exported unclassified grain mill products.

VESSEL COMPOSITION

Commercial vessel movements over WRPA 8 waterways and through the Port of Baton Rouge are summarized in table 59. Descriptions of typical vessels are contained in the Regional Summary.

FUTURE NEEDS

Prospective Commerce

Waterborne Commerce in the selected commodity categories was projected in accordance with indices of output developed for the appropriate major industry groups. These indices are shown on table 60. In general, the Program A indices represent OBER'S forecast of economic growth for the individual WRPA's within the Lower Mississippi Region. Program B indices were developed to reflect a regional growth in employment equal to the national average, 1.4 percent^{1/}. Application of these indices to the base year tonnages shown previously on table 58 yield future levels of commerce as shown in aggregate on table 61. These levels are designated as the gross needs of the area. Note that the projections are expressed in ton-miles for the waterways and in short tons for the Port of Baton Rouge.

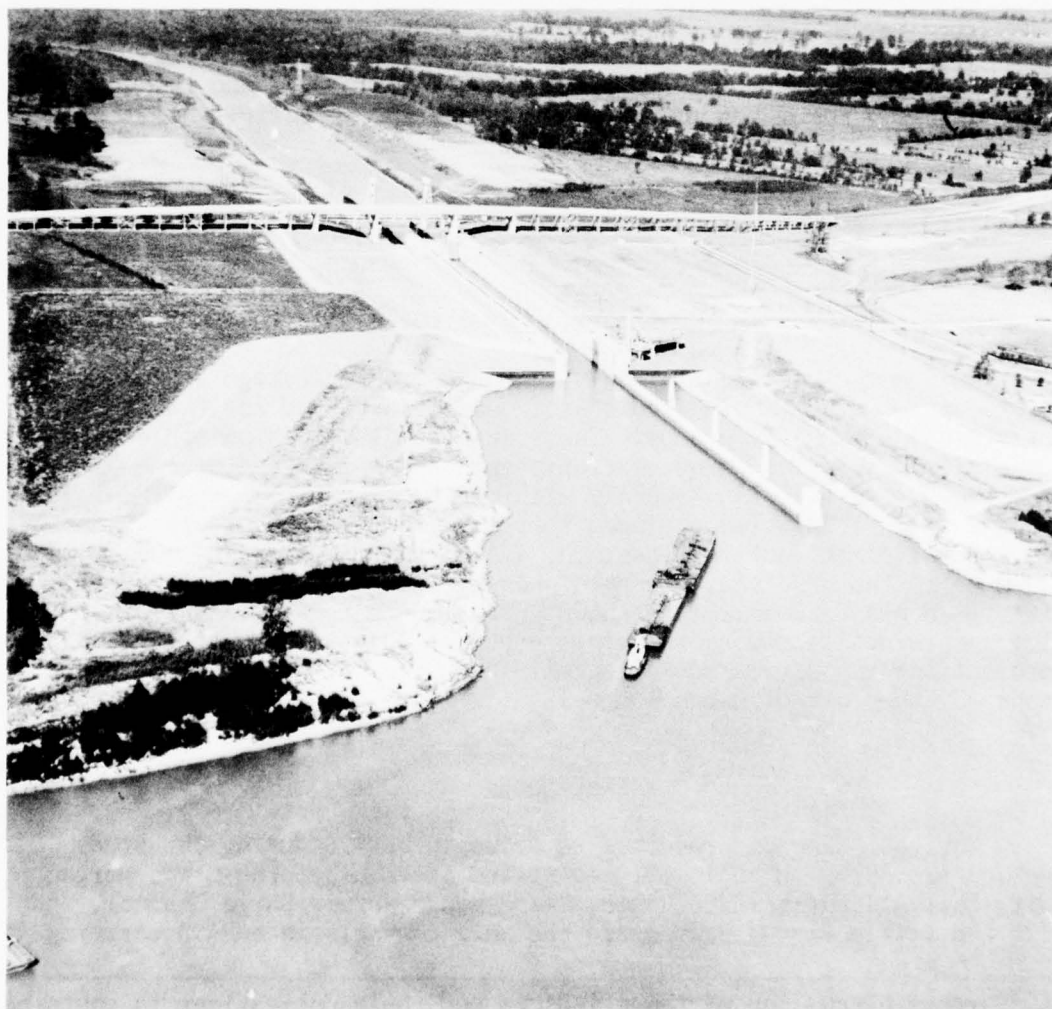
Net Needs

Navigation needs projected to arise in WRPA 8 during the study period are shown on table 62. As stated previously, the GIWW, Morgan City-Port Allen Alternate Route, Baton Rouge Harbor Barge Channel, and Big and Little Pigeon Bayous are the only channels in WRPA 8 carrying

^{1/} Further discussion of these indices and their derivations is contained in Appendix B, Economics.

significant commercial tonnages. Big and Little Pigeon Bayous, and the Baton Rouge Harbor Channel are considered to be adequate in terms of projected Program A and B gross needs. The existing capacity of the Morgan City-Port Allen Alternate Route is determined by the Bayou Sorrel and Port Allen Locks. It is projected that under Program A criteria, the capacity of these locks will be exceeded by 5.7 million tons and 62.4 million tons in the years 2000 and 2020, respectively. The corresponding shortfall in capacity under Program B projections will be 11.8 million tons and 78.9 million tons.

The remaining navigable facilities in WRPA 8 almost exclusively serve recreational needs. These are discussed separately in Appendix N, Recreation.



Tow entering Port Allen Lock from Mississippi River.

Table 59 - Vessel Trips, 1970, WSPA 8

	Inbound/Upbound/Eastbound/Northbound				Outbound/Downbound/Westbound/Southbound			
	Self-Propelled Vessels		Non-Self-Propelled Vessels		Self-Propelled Vessels		Non-Self-Propelled Vessels	
	Passenger	Towboat or Tugboat	Dry Cargo	Tanker	Passenger	Towboat or Tugboat	Dry Cargo	Tanker
Shallow-Draft Waterway	Dry Cargo	Tanker	Dry Cargo	Tanker	Dry Cargo	Tanker	Dry Cargo	Tanker
Amite River and Bayou Manchac, La.								
Baton Rouge Harbor (Devil's Swamp)								
Bayou Grosse Tete, La.	--	--	6	5	1	12	--	6
Big Pigeon and Little Pigeon Bayous, La.	2	--	206	24	193	425	2	193
Gulf Intracoastal Waterway-Morgan City to Port Allen Alternate Route	27	--	3,183	2,887	5,806	11,903	22	5,805
Pass Manchac, La.	--	--	28	51	--	79	--	--
Tangipahoa River, La.								
Tibidochaw, Natalbany, Pontchartroula, and Blood Rivers, La.								
Total	29	--	3,423	2,967	6,000	12,419	24	5,998
								12,401

No Vessel Trips Reported

Included in Port of Baton Rouge

No Vessel Trips Reported

No Vessel Trips Reported

Table 60 - Economic Forecast, WRPA 8
Indices of Productivity by Major Industries

Commodity (Industry Group)	Program	1967	1968	1969	1970	1980	2000	2020
Grain (Agriculture)	A	--	--	--	100	132	166	206
	B	--	--	--	100	132	178	221
Coal (Mining, National)	A	100	99	105	109	137	223	329
	B	100	99	105	109	137	223	329
Petroleum (Mining & Refining Average)	A	100	113	116	119	152	218	358
	B	100	113	117	121	166	253	422
CSSA (Quarrying)	A	100	84	101	102	109	176	301
	B	100	84	103	105	120	204	355
Sulfur (Quarrying)	A	100	100	100	100	100	100	100
	B	100	100	100	100	100	100	100
Iron & Steel, Aluminum Ores (Primary Metals)	A	100	178	184	192	275	496	852
	B	100	178	186	196	302	574	1,005
Industrial Chemicals (Chemicals & Allied Products)	A	100	117	123	133	220	631	1,611
	B	100	117	124	135	241	730	1,900
Agricultural Chemicals (Agriculture)	A	--	--	--	100	132	166	206
	B	--	--	--	100	132	178	221
Other Commodities (Chemical & Allied Products)	A	100	117	123	132	220	631	1,611
	B	100	117	124	133	241	730	1,900
Miscellaneous Commo- dities (Other Manufacturing)	A	100	105	111	117	183	441	1,017
	B	100	105	111	119	201	510	1,199

Table 61 - Present and Prospective Waterborne Commerce, WRPA 8

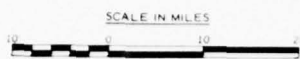
Waterway or Port	1970 Commerce		Program A		Program B	
	1980	2000	1980	2020	1980	2020
	Shallow Draft (Ton-Miles x 1000)					
Baton Rouge Harbor (Devil's Swamp)			Included in Port of Baton Rouge			
Bayou Grosse Tete, La.	24	28	49	91	30	55
Big Pigeon and Little Pigeon Bayous, La.	1,753	2,241	3,230	5,328	2,407	3,687
Gulf Intracoastal Waterway-Morgan City to Port Allen Alternate Route	1,011,763	1,513,560	3,081,690	6,529,267	1,621,297	3,452,000
Pass Manchac, La.	455	486	785	1,343	520	884
TOTAL	1,013,995	1,516,315	3,085,754	6,536,029	1,624,254	3,456,626
	Ports (Short Tons x 1000)					
Port of Baton Rouge:						
Shallow Draft	22,013	30,243	55,540	109,490	33,323	70,027
Coastwise	9,549	12,723	21,032	38,468	14,236	26,751
Imports	7,211	9,592	16,252	28,254	10,445	20,758
Exports	6,763	9,311	17,053	33,186	9,905	20,461
Total	45,535	61,869	109,877	209,398	67,909	137,997
						285,606

Table 62 - Navigation Needs, WRPA 8

Item	Program A		Program B	
	1970	1980 2000	1980 2000	2020
Deep-draft Channels (10 ⁶ Ton-Miles)				
New Channels				
Gross Need		NONE	NONE	
Existing Supply				
Net Need				
Existing Facilities Improvement				
Gross Need		NONE	NONE	
Existing Supply				
Net Need				
Shallow-draft Channels (10 ⁶ Ton-Miles)				
New Channels				
Gross Need		NONE	NONE	
Existing Supply				
Net Need				
Existing Facilities Improvement				
Gross Need		NONE	NONE	
Existing Supply				
Net Need				
Deep-draft Navigations Locks (# Ship Lockages)				
Gross Need		NONE	NONE	
Existing Supply				
Net Need				
Shallow-draft Navigation Locks (10 ⁶ Tons)				
Gross Need	16.4	24.9	26.8	123.9
Existing Supply	16.4	24.9	26.8	45.0
Net Need	0	0	0	78.9

Table 62 - Navigation Needs, WRPA 8 (cont.)

Item	Program A		Program B	
	1970	1980 2000	1980 2000	2020
Deep-draft Harbors and Ports (10 ⁶ Tons)				
Gross Need		NONE		NONE
Existing Supply				
Net Need				
Shallow-draft Harbors and Ports (10 ⁶ Tons)				
Gross Need		NONE		NONE
Existing Supply				
Net Need				



LEGEND

- HYDROLOGICAL BOUNDARY
- STATE BOUNDARY
- PARISH OR COUNTY BOUNDARY



LOCATION MAP



LOWER MISSISSIPPI REGION
COMPREHENSIVE STUDY

MAJOR STREAMS AND NAVIGABLE WATERWAYS

WRPA-8

FIGURE 9

W R P A 9

GENERAL DESCRIPTION

WRPA 9, which represents 13 percent of the study area, comprises all or portions of 21 southwestern and south-central Louisiana parishes. Total area amounts to 13,296 square miles. This WRPA ranges from the Sabine River watershed near the Texas stateline eastward to the East Atchafalaya Basin Protection Levee, and south from the Red River Basin in the area of Alexandria, Louisiana, to the Gulf of Mexico. About 30 percent of the total land area in the state of Louisiana is contained in WRPA 9. The topography varies from coastal marshes in the south through central plains which finally rise to rolling wooded hills in the northern part of the area.

The subtropical latitudes and the warm Gulf of Mexico are the major determinants of local climate, which is characterized by hot summers and mild winters. Average monthly temperatures range from 82° F. in August to 54° F. in January. Normal annual precipitation is about 38 inches.

Existing Economic Development

WRPA 9 enjoys a diversified economy based on petroleum exploration, production and refining salt and sulphur mining, timber, chemical manufacturing, commercial fishing, and agriculture.

These activities reflect the rich resource base of WRPA 9. Oil and gas fields are located throughout the area, and offshore. Sulphur deposits are found in Calcasieu Parish, while extensive salt deposits exist in the southern portions of the WRPA. The value of all minerals produced in WRPA 9 for 1969 comprised a third of the \$4.7 billion Louisiana total. Commercial forests covered about 41 percent of the total WRPA 9 land area in 1970. Rice, sugarcane, and soybeans represent the most important crops in the area, and, together with hay, cotton, and corn, have comprised over 95 percent of recent harvests. In addition, those larger towns and cities in the southern part of the area which have access to the commercial waterways have developed a sizable transportation service industry.

Total population in WRPA 9 has increased 60.7 percent since 1940 to 748,433 in 1970. Increasing industrialization of WRPA 9 has been reflected in the growth of urban population, which has increased from 30 percent in 1940 to 57 percent in 1970. Major population centers within the area include Lake Charles, Lafayette, and Alexandria. 1970 populations for the Lake Charles and the Lafayette SMSA's were 145,415 and 109,716, respectively, while the 1970 population of Alexandria was 41,557.

Transportation Facilities (Excluding Waterways)

Railways

Numerous railways serve WRPA 9. The more important lines among them are the Southern Pacific Company, the Kansas City Southern Lines, the Missouri Pacific Railroad Company, and the Texas and Pacific Railway Company.

Highways

WRPA 9 is traversed by many local, state, and federal highways. A listing of those of major importance is as follows:

- U. S. Highway 71 - Adjoining U. S. Highway 190, U. S. Highway 71 cuts through the northeast corner of WRPA 9 running in a northwesterly direction.
- U. S. Highway 90 - U. S. Highway 90 runs in an east-west direction from Texas through Lake Charles and into Lafayette where it changes to a southeasterly direction passing through Morgan City.
- U. S. Highway 167 - Beginning in Lafayette, U. S. Highway 167 runs in a northerly direction.
- U. S. Highway 171 - Located in the western portion of WRPA 9, U. S. Highway 171 runs in a northerly direction out of Lake Charles.
- U. S. Highway 190 - Passing in an east-west direction in WRPA 9, U. S. Highway 190 passes through Opelousas.
- Interstate 10 - Running in an east-west direction, Interstate 10 passes through Lake Charles and Lafayette and parallels U. S. Highway 90 between these cities.

Airlines

There are three commercial airports located in WRPA 9, one in Lake Charles, one in Lafayette, and one in Leesville. The Lake Charles and Lafayette fields are equipped to handle nationally operating commercial jet aircraft, while the Leesville facility is limited to commercial propeller aircraft.

Pipelines

WRPA 9 contains an elaborate network of onshore and adjacent offshore oil and gas pipelines. These lines range in size from small 2-inch diameter local lines up to the large 36-inch major interstate transmission lines.

EXISTING NAVIGATION IMPROVEMENTS

General

Table 63 contains a listing and brief description of existing navigation improvements within WRPA 9. Detailed information may be found in Appendix D, Inventory of Facilities.

Shallow-Draft Channels

The dominant navigation feature of WRPA 9 is the Gulf Intracoastal Waterway. Together with its tributary channels, it provides the southern half of WRPA 9 with a well-developed shallow-draft transportation system vital to the mineral resource oriented portion of the area economy. Petroleum and its products comprise the bulk of the tonnage movements over the GIWW main stem as well as most of the remaining WRPA 9 waterways. Notable exceptions are: Bayous Petit Anse, Tigre, and Carlin over which bulk salt movements predominate; and the Atchafalaya River below Morgan City, and Freshwater Bayou on which marine shells comprise the majority of tonnage movements.

In addition to the above commercial channels, there exists within the coastal marshes of WRPA 9 a labyrinthine network of pipeline and drainage canals which are heavily used by recreational craft and inland fishermen and, to a lesser degree, by oil exploration and service craft.

Deep-Draft Channels

The Calcasieu River and Pass provide a 40 X 400 foot deep-draft navigation channel from the Gulf of Mexico to public wharves located in the city of Lake Charles, Louisiana, a distance of about 34 miles. The deep-draft channel extends an additional 2 miles upstream at dimensions of 35 feet X 250 feet and terminates in a 35-foot X 750-foot X 1000-foot turning basin. In addition, this main channel is intersected by two short connecting channels, Devil's Elbow Industrial Canal at mile 22.5, and Coon Island Channel (30 feet X 100 feet) at mile 32.2.

The Atchafalaya River below Morgan City, Louisiana, is authorized at dimensions of 20 feet X 200 feet across Atchafalaya Bay to the 20-foot contour in the Gulf of Mexico. The portion of the channel in the bay, however, is only dredged to 18 feet X 200 feet and between dredgings silts to dimensions as small as 12 feet X 140 feet. The remainder of the channel is self-maintaining at greater than authorized dimensions.

Table 63 - Existing Navigation Improvements^{1/}, WRPA 9

<u>Shallow-Draft Channels</u>	<u>Depth</u> <u>feet</u>	<u>Width</u> <u>feet</u>	<u>Length</u> <u>miles</u>	<u>Remarks/Section Included</u> ^{2/}
Atchafalaya River, Morgan City to Old River, La.	12	125	121	Old River Lock at Mississippi River to Morgan City, La.
Bayous Petit Anse, Tigre, and Carlin, La.	9	80	14	Bayou Petit Anse from Gulf Intracoastal Waterway (Mi. 145.7 WHL) to head of Avery Island, La. Bayou Carlin from mouth to Jefferson Island, La.
Bayou Plaquemine Brule	6	60	19	From its junction with Bayou De Cannes to Crowley, La.
Bayou Teche	8 6	80 50	50 57 107	Mouth to Mi. 50 near New Iberia, La.
Calcasieu River	9	Not Specified	49	From Lake Charles, Mi. 37, to Phillips Bluff, La., Mi. 85.9; non-navigable above Mi. 60.
Franklin Canal	8	40	6	From GIWW (Mi. 121 WHL) to Franklin, La.
Freshwater Bayou	12	125	20	GIWW (Mi. 161.2 WHL) to Gulf of Mexico.
Gulf Intracoastal Waterway	12	125	171	From Atchafalaya River, La., (GIWW Mi. 95.5 WHL) to Sabine River, Texas (Mi. 266 WHL).
Mermentau River, La. (GIWW-Schooner Bayou Section)	<u>3/</u> <u>3/</u>	<u>3/</u> <u>3/</u>	35 45 80	Mermentau River at the GIWW to the Gulf of Mexico. Mermentau River at the GIWW to the GIWW in the vicinity of Vermilion Lock via Grand and White Lakes and Schooner Bayou.
Mermentau River, Bayous Nezpique & Des Cannes	9 12 12	100 100 100	35 25 9 67	Mermentau River from its junction with GIWW (Mi. 202.2 WHL) Mermentau, La.; Bayou Nezpique from its mouth to Mi. 25; Bayou Des Cannes from its mouth to Mi. 9.
Vermilion River	9	80	51	Vermilion Bay to Lafayette, La.; Vermilion River intersects GIWW at Mi. 159 WHL.
<u>Deep-Draft Channels</u>				
Atchafalaya River, Morgan City to Gulf of Mexico	20	200	38	From Morgan City, La. to 20-foot contours in Gulf; due to shoaling the controlling depth is 11 feet over bar; Bay Channel, 14 feet; Existing project depth, 20 feet.

^{1/} Detailed information on existing facilities may be found in Appendix D, Inventory of Facilities.

^{2/} Points on Mississippi River are expressed as miles above the Head of Passes (AHP); Points on the GIWW are expressed as miles east or west of Harvey Lock in New Orleans (EHL, WHL).

^{3/} Project provides for a channel cross section of 3,000 square feet below mean low gulf, except for short sections of 6 feet X 60 feet, and 5 feet X 40 feet.

Table 63 - Existing Navigation Improvements^{1/}, WRPA 9 (cont'd)

<u>Deep-Draft Channels</u>	<u>Depth feet</u>	<u>Width feet</u>	<u>Length miles</u>	<u>Remarks/Section Included^{2/}</u>
Calcasieu River & Pass, La.	40	400	58	From Lake Charles, La., to 42-foot contour in Gulf of Mexico.
Devil's Elbow, La.	35	300	3	The channel connects with Calcasieu River (Mi. 22.5) at its intersection with the GIWW (Mi. 241.2).
Coon Island, La.	30	100	1.5	The channel is located 1.5 miles downstream from Lake Charles at Mi. 32.2, right descending bank of Calcasieu River.
<u>Ports</u>				
Lake Charles, La.	40	400	20	The port of Lake Charles includes part of Calcasieu River and Pass, Devil's Elbow, and Coon Island Channels. Principal waterborne commerce handled at port are crude petroleum, petroleum products, chemicals, rice, and unmanufactured marine shell. Detailed information on facilities can be found in Existing Facilities Report.
Morgan City, La.	20	200	3	Technically, Morgan City can be classified as a port since the existing project calls for 20-foot depth. Principal commodities moving through the port are unmanufactured shells, petroleum, and miscellaneous equipment for fabrication and repairs of large marine structures for offshore oil industry.
<u>Locks</u>	<u>Depth over Sill feet</u>	<u>Width feet</u>	<u>Length feet</u>	<u>Remarks/Section Included^{2/}</u>
Calcasieu Lock	13	75	1,206	Opened to Navigation in 1950
Vermilion Lock	11.3	56	1,182	Opened to Navigation in 1933
Freshwater Bayou Lock	16	84	600	Opened to Navigation in 1968
Old River Lock	13	75	1,200	Opened to Navigation in 1963

^{1/} Detailed information on existing facilities may be found in Appendix D, Inventory of Facilities.

^{2/} Points on Mississippi River are expressed as miles above the Head of Passes (AHP); Points on the GIWW are expressed as miles east or west of Harvey Lock in New Orleans (EHL, WHL).

Locks

There are four shallow-draft locks located in WRPA 9. They are the Calcasieu, Vermilion, Freshwater Bayou, and Old River Locks. Calcasieu and Vermilion Locks, located on the GIWW at Miles 162.7^{1/2} and 138.4^{1/2} respectively, function primarily to prevent salt water intrusion into the Mermentau River Basin. Similarly, Freshwater Bayou Lock serves to prevent salt water intrusion into the marshes located adjacent to the channel above the lock.

The Old River Lock, located near Mississippi River Mile 304 AHP, serves as the connection between that river and the Atchafalaya and Red Rivers.

Ports

The principal deepwater port in WRPA 9 is the Port of Lake Charles, Louisiana. In 1970 this port ranked twentieth in the United States in terms of tonnage handled. The waterfront limits at the port include both sides of the Calcasieu River northward from the Calcasieu-Cameron Parish line to the public wharves opposite Clooney Island, a distance of about 15 miles, and above the public wharves for an additional 11.5 miles. The port facilities include about sixty public and private wharves located on the main channel, on the industrial canal at Devil's Elbow, and on the Coon Island Channel. Twenty-one of these wharves are designed to handle petroleum and petrochemical products. Additionally, the Lake Charles Harbor and Terminal District operates 22 public warehouses with a total of 427,200 square feet of space plus 115,000 square feet of open storage. Morgan City, although technically a deep-draft port by virtue of its authorized 20-foot X 200-foot channel, actually supports only minor foreign and coastwise trade, consisting primarily of large offshore oilfield production and construction equipment which is built and serviced in the area.

Its close proximity to offshore oil activities and marine shell deposits, combined with its location on the GIWW does, however, give rise to considerable shallow-draft movements, as shown on table 68.

In addition to the above two ports, there are a number of smaller specialized ports throughout WRPA 9. Those which have legally constituted harbor and terminal authorities are shown in the regional summary.

^{1/2} Mileage west of Harvey Lock.

Navigation Aids

The U. S. Coast Guard maintains all necessary aids to navigation on Federally constructed channels, and marks hazards to navigation.

AUTHORIZED NAVIGATION IMPROVEMENTS

Navigation improvements authorized for Federal construction within WRPA 9 are shown on table 64.

Shallow-Draft Channels

The River and Harbor Act of 1962 authorized the enlargement of the existing 12 feet X 125 feet GIWW between New Orleans, Louisiana, and the Houston Ship Channel. The dimensions specified for the section traversing WRPA 9 are 16 feet X 200 feet. The River and Harbor Act of 1965 authorized several cutoffs of dimensions 12 feet X 125 feet in the Mermentau River above Lake Arthur and in Bayous Nezpieque and Des Cannes, and authorized replacement of the highway bridge over the Mermentau River at the city of Lake Arthur.

Deep-Draft Channels

The previously mentioned industrial canal located at the Devil's Elbow loop of the Calcasieu River below Lake Charles, Louisiana, was authorized for enlargement by the Flood Control Act of 1965. The existing canal will be enlarged to the same dimensions as the Calcasieu River main channel, 40 feet X 400 feet, and will be slightly lengthened. In addition, a 40-foot X 1000-foot X 1000-foot turning basin will be constructed at the landward end of the channel.

Locks

Replacement of the Vermilion Lock was approved by the Secretary of the Army in May 1967, under authority granted in the River and Harbor Act of 1909. The new lock will be located near the existing one. Currently authorized dimensions for the replacement lock are 75 feet X 1200 feet with a sill elevation of -15 feet mean low gulf.

Table 64 - Authorized Navigation Improvements, WSPA 9

<u>Shallow-Draft Channels</u>				<u>Remarks</u>
	<u>Depth</u> feet	<u>Width</u> feet	<u>Length</u> miles	
Gulf Intracoastal Waterway	16	200	171	Section Included: From Atchafalaya River, La., to Sabine River, Tex.
Mermentau River, Bayous Nezpieque & Des Cannes	12	125	67	That section of Mermentau River through Lake Arthur is authorized to 12-by-200 feet for approximately 6 miles.
<u>Deep-Draft Channels</u>				
Devil's Elbow	40	400	3	
				Will serve as a deep water channel for an Industrial Park (800 acres). The park is an addition to the Port of Lake Charles.
<u>Locks</u>				
	<u>Depth</u> over Sill feet	<u>Width</u> feet	<u>Length</u> feet	
Vermilion Lock	15	75	1,200	

EXISTING COMMERCE

General

1970 waterborne commerce for WRPA 9 waterways is shown by commodity categories on table 65. These movements are discussed individually in succeeding paragraphs.

Inland Commerce

Grain

The only significant shallow-draft grain movements in WRPA 9 consist primarily of northbound soybeans on the Atchafalaya River and westbound through movements of feed grains over the GIWW destined for Texas.

Coal

Shallow-draft coal movements within WRPA 9 are confined to westbound through tows on the GIWW destined for steam-electric generating plants in Texas. These movements originate almost exclusively on the Ohio River System and reach the GIWW via the Mississippi River and the Morgan City - Port Allen Alternate route.

Petroleum

Crude petroleum and refined products account for 66 percent of all tonnage moving on WRPA 9 waterways in 1970. Movements under this category consisted mainly of crude petroleum westbound to refineries in Texas and southwestern Louisiana, and eastbound movements of refined products, principally gasoline and residual fuel oil.

This pattern of movements is a function of the distribution of refineries and oilfields in the Gulf Coast area and is expected to obtain with little change for the entire study period.

Cement, Stone, Sand, and Aggregate (CSSA)

As shown on table 65, the GIWW, the Lower Atchafalaya River, and the Calcasieu River support the preponderance of WRPA 9 movements in this category. The large majority of these movements are comprised of unmanufactured marine shells which originate at reefs located South of Morgan City in the Atchafalaya Bay, and in Lake Pontchartrain near New Orleans. These shells find a variety of uses including road construction and maintenance, oilfield construction, and as raw material for the production of Portland cement. Also included in the CSSA category are smaller amounts of building cement, sand, and gravel used in general construction.

Sulphur

Virtually all WRPA 9 movements of sulphur consist of bulk liquid

Table 65 - 1970 Waterborne Commerce, WRPA 9

Waterway	Grain	Coal	Petroleum	CSSA ^{1/}	Sulphur	Iron & Steel			Industrial Chemicals	Agricultural Chemicals	Other	General Cargo	Total
						Inland Tonnage Short Tons							
Atchafalaya River, Morgan City to Old River, La.	83,348	--	3,539,319	99,847	19,713	14,448	573,023	31,755	--	--	--	543,581	4,905,034
Atchafalaya River, Morgan City to Gulf of Mexico	--	--	1,029,060	2,600,503	--	24,263	13,869	--	--	--	--	470,796	4,138,491
Bayous Petit Anse, Tigre, and Carlin, La.	--	--	128,214	0	--	17,890	--	--	--	1,335,708	--	2,588	1,484,400
Bayou Plaquemine Brule	--	--	31,212	50,329	--	--	--	--	--	--	--	--	81,541
Bayou Teche	22,334	--	265,253	223,327	--	9,380	--	--	1,670	116,413	--	10,700	649,077
Calcasieu River	--	--	9,752,303	1,040,791	--	5,912	1,327,146	9,368	--	--	--	237,149	12,372,669
Franklin Canal	--	--	7,325	--	--	--	--	--	--	--	--	43	7,368
Freshwater Canal	--	--	15,123	18,190	--	510	--	--	--	--	--	584	34,407
Gulf Intracoastal Waterway	103,990	289,498	30,742,844	3,689,612	229,795	1,372,310	5,612,799	770,865	5,435,466	1,424,960	49,672,139	--	--
Mermentau River, La. (GIWW-Schooner Bayou Section)	--	--	780,035	31,378	--	10,511	1,156	--	--	--	--	20,707	843,787
Mermentau River Bayous Nezpieque & Des Cannes	21,518	--	1,562,761	122,437	--	10,403	9,607	--	--	--	--	9,742	1,736,468
Vermilion River	--	--	919,977	180,210	--	6,867	2,514	--	--	--	--	89,314	1,198,882

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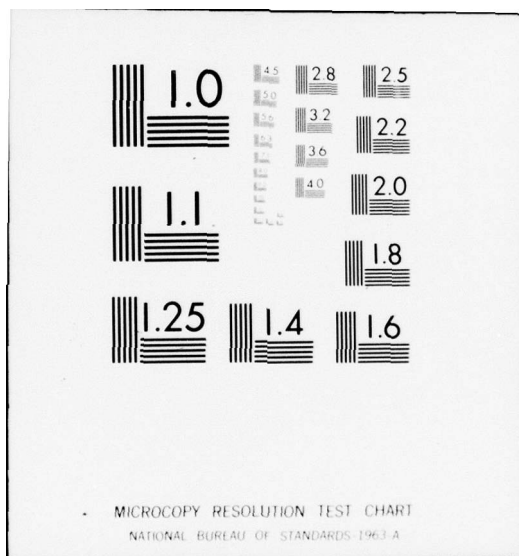


Table 65 - 1970 Waterborne Commerce, WSPA 9 (cont'd)

Waterway	Grain	Coal	Petroleum	CSSA ^{1/}	Coastwise Traffic				Iron & Steel	Industrial Agricultural		Other	General Cargo	Total
					Sulphur	Short Tons				Chemicals	Chemicals			
Atchafalaya River, Morgan City to Gulf of Mexico	--	--	--	1,295	--	--	--	--	--	--	--	--	--	1,295
Calcasieu River	34,147	--	3,068,464	194	--	--	10	276,179	20,962	1,522	14,258	3,418,736		
Foreign Trade														
Short Tons														
Atchafalaya River, Morgan City to Gulf of Mexico	--	4	69	316	--	--	2,469	10	--	--	92	4,563	7,523	
Calcasieu River	516,309	398,195	88,500	--	--	--	829	524,807	15,801	156,319	184,815	1,884,855		

^{1/} Cement, Stone, Sand, and Aggregate

shipments on the GIWW, originating in the vicinity of Larose, Louisiana, and destined for the Beaumont, Texas, area.

Iron and Steel

Over 90 percent of iron and steel improvements within WRPA 9 occur on the GIWW. Primarily, these movements are petroleum-related materials, such as drill pipe and casing, and pipeline tubing, originating on the Ohio River and Great Lakes Systems and destined for ports or oil field supply depots located on the Louisiana and Texas section of the GIWW.

Industrial Chemicals

Movements under this category consist in the main of basic chemicals, benzene, toluene, alcohols, and caustic soda eastbound on the GIWW in through tows from chemical and petrochemical production facilities in southwest Louisiana and eastern Texas. Most of this tonnage enters the Mississippi River at Baton Rouge via the MC-PA Route and is either moved upriver or exported from that point.

Agricultural Chemicals

Agricultural chemical tonnages are made up of various types of fertilizers moving in through tows on the GIWW. These movements are predominantly between points on the Texas Gulf coast and points on the Upper Mississippi and Ohio Rivers.

Other

Movements under this heading on WRPA 9 waterways consist almost exclusively of bulk salt originating at mines located on Bayous Petit Anse and Carlin, and near the GIWW between miles 100 and 140 West of Harvey Lock. This salt moves to points on the Mississippi River System and the GIWW east of New Orleans.

General Cargo

Significant general cargo tonnages moving within WRPA 9 include shipments of such items as miscellaneous manufactured goods, preformed concrete products, scrap metal, drilling water, waterway improvement materials, and paper products.

Coastwise Trade

As seen in table 65, the only significant coastwise traffic involving WRPA 9 is comprised of petroleum and chemical tonnages being shipped from Lake Charles to the East and West coasts of the United States. These two categories accounted for over 98 percent of 1970 coastwise movements in WRPA 9. About 30 percent of the petroleum shipments consist of crude oil with the remaining 70 percent made up of the various refined products, principally gasoline. The bulk of the chemical movements are represented by shipments of sodium hydroxide (caustic soda).

Foreign Trade

The bulk of the foreign trade conducted in WRPA 9 is comprised of exports under the categories of grain, coal, and industrial chemicals shipped from the Port of Lake Charles.

Virtually all of the grain exports are represented by rice. Tonnage exported in the "Coal" category is comprised exclusively of calcined coke, while the industrial chemical shipments consist mainly of unclassified basic chemicals. Other significant movements include exported paper, residual fuel oil, and lubricants, and imported non-metallic minerals. In addition to the above commerce involving Lake Charles, a small amount of foreign commerce is supported by the Port of Morgan City. This trade is comprised primarily of imported fish and shellfish, and exported iron and steel articles.

VESSEL COMPOSITION

Table 66 summarizes commercial vessel movements over WRPA 9 waterways. Descriptions of typical vessels and tow composition are contained in the Regional Summary.

FUTURE NEEDS

Prospective Commerce

Waterborne commerce in the selected commodity categories was projected in accordance with indices of output developed for the appropriate major industry groups. These indices are shown on table 67. In general, the Program A indices represent OBERS' forecast of economic growth for the individual WRPA's within the Lower Mississippi Region. Program B indices were developed to reflect a regional growth in employment equal to the national average, 1.4 percent^{1/}. Application of these indices to the base year tonnages shown previously on table 65 yield future levels of commerce as shown in aggregate on table 68. These levels are designated as the gross needs of the area. Note that the projections are expressed in ton-miles for the waterways and in short tons for the ports.

^{1/} Further discussion of these indices and their derivations is contained in Appendix B, Economics.

Table 66 - Vessel Trips, 1970, WRPA 9

	Inbound/Upbound/Eastbound/Northbound					Outbound/Downbound/Westbound/Southbound						
	Self-Propelled Vessels			Non-Self-Propelled Vessels		Self-Propelled Vessels			Non-Self-Propelled Vessels			
	Passenger & Dry Cargo	Tanker	Towboat or Tugboat	Dry Cargo	Total	Passenger & Dry Cargo	Tanker	Towboat or Tugboat	Dry Cargo	Total		
Shallow-Draft Waterway	18	0	1,537	932	2,057	4,544	18	0	1,537	846	2,056	4,544
Atchafalaya River, Morgan City to Old River, La.												
Atchafalaya River, Morgan City to Gulf of Mexico (Port of Morgan City)	7,752	0	3,151	1,864	1,062	13,811	7,752	0	3,151	1,846	1,062	13,812
Bayous Petit Anse, Tigre, and Carlin, La.	937	0	444	969	355	2,705	937	0	445	970	354	2,706
Bayou Plaquemine Brule, La.	1	0	47	42	25	115	1	0	47	42	27	117
Bayou Teche, La.	1	0	603	585	253	1,442	2	0	601	584	254	1,441
Calcasieu River and Pass, La. (Port of Lake Charles)	4,114	47	3,318	1,227	5,830	14,536	4,079	7	3,316	1,231	5,815	14,448
Franklin Canal, La.	41	0	65	0	45	149	41	0	64	0	45	150
Freshwater Bayou, La.	17	0	140	96	46	299	18	0	139	96	44	297

Table 67 - Economic Forecast, WRPA 9
Indices of Productivity by Major Industries

Commodity (Industry Group)	Program	1967	1968	1969	1970	1980	2000	2020
Grain (Agriculture)	A	--	100	102	104	129	156	179
	B	--	100	102	104	129	168	192
Coal (Mining, National)	A	100	104	106	109	143	199	323
	B	100	104	106	109	143	199	323
Petroleum (Mining & Refining, Average)	A	100	122	126	130	182	311	569
	B	100	122	126	132	199	360	671
CSSA (Quarrying)	A	100	105	108	112	163	317	618
	B	100	105	109	114	179	367	729
Sulphur (Quarrying)	A	100	105	108	112	163	317	618
	B	100	105	109	114	179	367	729
Iron & Steel (Primary Metals)	A	100	103	105	108	141	218	340
	B	100	103	105	108	141	218	340
Industrial Chemicals (Chemicals & Allied Products)	A	100	110	116	122	203	501	1,198
	B	100	110	117	124	223	579	1,413
Agricultural Chemicals (Agriculture)	A	--	100	102	104	129	156	179
	B	--	100	102	104	129	168	192
Other Commodities (Chemicals & Allied Products)	A	100	110	116	122	203	501	1,198
	B	100	110	117	124	223	579	1,413
Miscellaneous Commod- ities (Other Manu- facturing)	A	--	100	106	112	195	481	1,100
	B	--	100	106	113	214	556	1,297

Table 68 - Present and Prospective Waterborne Commerce, WSPA 9

Waterway or Port	1970 Commerce	Program A			Program B		
		1980	2000	2020	1980	2000	2020
		Shallow Draft (Ton-Miles x 1000)					
Atchafalaya River, Morgan City to Old River, La.	424,308	644,774	1,315,535	2,744,075	703,619	1,516,860	3,226,160
Atchafalaya River, Morgan City to Gulf of Mexico	143,192	223,917	437,673	865,751	243,992	503,098	1,014,299
Bayous Petit Anse, Tigre, and Carlin, La.	11,040	18,150	43,882	103,739	19,774	50,308	121,355
Bayou Plaquemine Brule	1,373	1,956	3,558	6,721	2,134	4,100	7,890
Bayou Teche	37,770	54,458	101,621	198,765	59,177	116,828	232,934
Calcasieu River	131,150	178,875	330,773	647,692	194,648	380,710	759,872
Franklin Canal	36	51	90	170	56	105	201
Freshwater Bayou	502	720	1,330	2,539	776	1,514	2,942
GNW:							
Calcasieu River to Sabine River	1,010,616	1,463,191	2,735,873	5,393,032	1,592,380	3,143,220	6,320,059
Calcasieu River to Vermilion R.	3,684,870	5,345,106	10,040,690	19,857,786	5,814,725	11,536,083	23,259,443
Vermilion River to Atchafalaya R.	2,956,249	4,287,188	8,049,826	15,915,491	4,663,685	10,848,323	18,641,117
Mermentau River, La. GNM-Schooner Bayou Section	18,645	29,751	48,407	92,326	29,249	55,977	108,786
Mermentau River, Bayous Nezpique & Des Cannes	50,162	70,418	121,422	223,415	76,944	140,410	263,203
Vermilion River	13,938	20,083	36,845	70,746	21,939	42,542	83,236
Calcasieu River Extension	1,800	2,569	4,767	9,166	2,800	5,437	10,655
Catahoula-Charenton	--	--	160,830	321,375	--	183,210	373,125
TOTAL	8,485,651	12,338,207	23,433,122	46,452,789	13,425,898	28,530,725	54,425,277

Table 68 - Present and Prospective Waterborne Commerce, WRPA 9 (cont'd)

Waterway or Port	1970 Commerce	Program A		Program B	
		1980	2000	1980	2000
		<u>Coastwise</u> (Ton-Miles x 1000)			
Atchafalaya River - Morgan City to the Gulf	48	70	137	78	159
Calcasieu River & Pass	110,767	148,392	274,428	161,482	315,868
Coon Island	--	687	1,824	804	2,135
Devil's Elbow	--	--	--	--	--
La. Intracoastal Seaway	--	--	1,250,000	--	1,465,000
Subtotal	110,815	149,149	276,389	162,364	318,162
		<u>Foreign</u> (Ton-Miles x 1000)			
Atchafalaya River - Morgan City to Gulf	278	433	847	470	973
Calcasieu River & Pass	61,069	85,925	158,890	93,506	182,866
Coon Island	--	338	898	396	1,051
Devil's Elbow	--	598	1,660	700	1,942
Subtotal	61,357	87,294	162,295	95,072	186,832
TOTAL	172,162	236,413	438,684	257,436	504,994
		<u>Ports</u> (Short Tons x 1000)			
		<u>Shallow Draft</u>			
Port of Lake Charles	12,373	16,875	31,205	18,363	35,916
Port of Morgan City	4,138	6,472	12,650	7,052	14,540
			25,022		29,315
			61,103		71,686
			2,110,469		2,474,478

Table 68 - Present and Prospective Waterborne Commerce, WSPA 9 (cont'd)

<u>Waterway or Port</u>	<u>1970 Commerce</u>	<u>Program A</u>		<u>Program B</u>	
		<u>1980</u>	<u>2020</u>	<u>2000</u>	<u>2020</u>
		<u>Coastwise</u>			
Port of Lake Charles	3,419	4,580	8,470	4,984	19,458
Port of Morgan City	1	2	4	2	9
		<u>Foreign</u>			
Port of Lake Charles	1,885	2,652	4,904	2,886	11,265
Port of Morgan City	8	12	25	13	53
		<u>Total</u>			
Port of Lake Charles	17,677	24,107	44,579	26,233	102,409
Port of Morgan City	4,147	6,486	12,677	7,067	29,577
TOTAL	21,824	30,593	57,256	33,300	131,786

Net Needs

Table 69 summarizes the net navigation needs required to support the WRPA commerce projected under Program A and B objectives.

Shallow-Draft Channels

As shown in the table, improvement of existing channels will be required beginning in 1980 under both programs. In addition, new channel construction will be required by the year 2000 to satisfy net needs.

Deep-Draft Channels

No new deep channel construction will be required in WRPA 9 under either program until 2020. Continued growth in the Port of Lake Charles, however, will give rise to net needs in improvements to existing channels at that port as early as 1980.

Locks

By 1980, projected commerce over the GLWW under both Programs A and B will exceed existing shallow-draft lock capacities in WRPA 9. The amount of the needed additional capacity in the years 1980, 2000, and 2020 will be 1,000,000 tons, 58,700,000 tons, and 181,400,000 tons, respectively, under Program A criteria, and 5,900,000 tons, 77,400,000 tons, and 223,900,000 tons under Program B.

Harbors and Ports

There are no net harbor or port needs projected to occur in WRPA 9 during the study period.

Table 69 - Navigation Needs, WSPA 9

Item	Program A			Program B		
	1970	1980	2000	1980	2000	2020
Deep-draft Channels (10 ⁶ Ton-Miles)						
New Channels						
Gross Need	172.2	236.4	438.7	257.4	505.0	2,474.5
Existing Supply	172.2	236.4	438.7	257.4	505.0	1,009.5
Net Need	0	0	0	0	0	1,465.0
Existing Facilities Improvement						
Gross Need	0	1.6	437.7	1.9	503.9	1,007.2
Existing Supply	0	0	0	0	0	0
Net Need	0	1.6	437.7	1.9	503.9	1,007.2
Shallow-draft Channels (10 ⁶ Ton-Miles)						
New Channels						
Gross Need	8,485.6	12,338.2	23,433.1	13,425.9	28,530.7	54,425.3
Existing Supply	8,485.6	12,338.2	23,272.3	13,425.9	28,347.5	54,052.2
Net Need	0	0	160.8	0	183.2	373.1
Existing Facilities Improvement						
Gross Need	0	88.6	21,034.7	96.7	25,769.9	46,702.0
Existing Supply	0	0	0	0	0	0
Net Need	0	88.6	21,034.7	96.7	25,769.9	46,702.0
Deep-draft Navigations Locks (# Ship Lockages)						
Gross Need					NONE	
Existing Supply						
Net Need						
Shallow-draft Navigation Locks (10 ⁶ Tons)						
Gross Need	45.8	67.8	125.5	72.7	144.2	290.7
Existing Supply	45.8	66.8	66.8	66.8	66.8	66.8
Net Need	0	1.0	58.7	5.9	77.4	223.9

Table 69 - Navigation Needs, WSPA 9 (cont.)

Item	Program A			Program B		
	1970	1980	2000	1980	2000	2020
Deep-draft Harbors and Ports (10 ⁶ Tons)						
Gross Need						
Existing Supply			NONE		NONE	
Net Need						
Shallow-draft Harbors and Ports (10 ⁶ Tons)						
Gross Need						
Existing Supply			NONE		NONE	
Net Need						

W R P A 1 0

GENERAL DESCRIPTION

WRPA 10 is made up of all or parts of 17 parishes in extreme southeastern Louisiana. It represents about 8 percent of the study area and covers 7,729 square miles. About 20 percent of the total Louisiana land area is contained within this WRPA. The Mississippi River divides WRPA 10 into two parts, with about two-thirds of the area lying south of the river. Land within WRPA 10 can be categorized topographically into 3 distinct regions, the alluvial ridges adjacent to the Mississippi River, the vast swamps and marshes along the coast, and the wooded hills north of Lake Pontchartrain. The swamps and marshlands comprise the greatest portion of WRPA 10, while most of the commercial development and population is concentrated along the alluvial ridges, which extend for as much as 5 miles from each river bank.

WRPA 10 has a warm, humid climate typical of the central coast of the Gulf of Mexico. Mild winters and hot summers prevail, with average temperatures ranging from 55 degrees F. in January to 83 degrees F. in July. Normal average annual rainfall amounts to about 60 inches.

Existing Economic Development

Economic activity in WRPA 10 is concentrated in three prime areas: Mineral production, petrochemical manufacturing, and the activities centered in the Port of New Orleans. Total value of mineral production in WRPA 10 (primarily oil and gas), represents over 50 percent of the state total. In addition to the numerous coastal and offshore oil and gas fields in the area, other minerals of commercial importance include salt, sulphur, sand and gravel, and marine shell.

The presence of these minerals combined with the Mississippi River as a source of cooling and process water has attracted a vast complex of chemical and petrochemical plants to the banks of the river between New Orleans and Baton Rouge. Total value of such investments within WRPA 10 has amounted to about \$1.5 billion since 1946.

The Port of New Orleans, which ranks second in the nation, handled over 123 million tons of commerce in 1970 which produced about a half billion dollars in direct revenues. Approximately 50 percent of this commerce was comprised of minerals and chemicals. Agriculture, although of declining economic importance, still accounts for about 14 percent of land usage within WRPA 10. About 40 percent of the agricultural lands are devoted to crops, with the remainder comprised principally of farm forests and pasture.

Additionally, the coastal and offshore areas of WRPA 10 support one of the nation's largest industrial and food fisheries. Important species include menhaden, shrimp, oysters, flounder, drum, and weakfish.

The major population center within WRPA 10 is the New Orleans SMSA, which comprises 80 percent of the WRPA 10 population. Total urban population within WRPA 10 has increased from 73 percent in 1940 to 83 percent in 1970, reflecting the increased industrial activity in the area.

Transportation Facilities (Excluding Waterways)

Railways

Railway services in WRPA 10 are provided by the Louisville and Nashville Railroad, the Southern Railway System, the Illinois Central Railroad, the Missouri Pacific Railroad Company, the Texas and Pacific Railway Company, and the Southern Pacific Company.

Highways

WRPA 10 is traversed by numerous local, state, and U. S., and Interstate highways. A listing of those of major importance is as follows:

- U. S. Highway 51 - This highway runs in a north-south direction providing the connection between Interstate 10 in WRPA 10 and Interstate 55 in WRPA 8.
- U. S. Highway 60 - Running in a northwesterly direction, this highway is currently the main artery between New Orleans and Baton Rouge.
- U. S. Highway 90 - Running in a northeasterly direction, this highway passes through New Orleans leading into the coastal marshes of Louisiana.
- U. S. Highway 190 - On the northern side of Lake Pontchartrain, U. S. Highway 190 roughly parallels the shoreline.
- Interstate 10 - Paralleling U. S. Highway 61, Interstate 10 passes through New Orleans.
- Interstate 12 - Currently under construction, Interstate 12 roughly parallels U. S. Highway 190.

Airlines

WRPA 10 is served by Moisant International Airport located just west of New Orleans in the town of Kenner. This field is equipped to handle all nationally and internationally operating aircraft now in

service. In addition, studies are presently underway regarding expansion of this facility or construction of a new field in order to accommodate anticipated advancements in future commercial aircraft.

Pipelines

Within WRPA 10 are a large number of oil and gas pipelines, with sizes ranging widely from small local collection lines of 4-inch diameter or has up to large interstate transmission lines of 30-inch diameter.

EXISTING NAVIGATION IMPROVEMENTS

General

Table 70 presents a list and brief description of existing navigation features within WRPA 10. Detailed information may be found in Appendix D, Inventory of Facilities.

Shallow-Draft Channels

As is the case in WRPA 9, the Gulf Intracoastal Waterway is the major component in the shallow-draft navigation network located within WRPA 10. Many of the channels are rather small dimensionally due to the fact that they predominately serve craft other than barges, such as fishing boats, oil field crew boats, and recreational craft, by providing access for these boats to the Gulf of Mexico. Minerals, particularly petroleum, constitute the majority of movements for most WRPA 10 waterways, reflecting the natural resource oriented economy of the area.

In addition to the commercial waterways, WRPA 10 also enjoys an intricate system of pipeline and drainage canals, many of which support a considerable amount of traffic by commercial fishing and recreational craft.

Deep-Draft Channels

The Inner Harbor Navigation (Industrial) Canal extends from the Mississippi River at a point 92.6 miles A.H.P. across the city of New Orleans to Lake Pontchartrain, a distance of 5.5 miles. A lock is located 2,000 feet from the river end and operated, toll free, on a 24-hour basis. A turning basin, 1,000 feet square by 30 feet deep, is 1.5 miles from the river and immediately south of the Florida Avenue Bridge. The portion of this canal between the Intracoastal Waterway and the Mississippi River, including the lock and two bridges, is operated by the U.S. Army Corps of Engineers. A third bridge in this reach is operated by the Louisiana State Department of Highways.

The Mississippi River - Gulf Outlet (MR-GO) affords a tidewater outlet to the Gulf that is about 37 miles shorter than the Mississippi River route. The project consists of a ship channel 36 feet deep and 500 feet wide extending approximately 76 miles in a land and water cut from the junction of the Inner Harbor Navigation Canal (IHNC) and the Gulf Intracoastal Waterway (GIWW) in New Orleans to the -38-foot contour in the Gulf. Jetties for the reduction of shoaling, a turning basin, and a lock and connecting channel with the Mississippi River are salient features of the project.

Locks

Table 70 contains a list of the locks within WRPA 10. All but the IHNC locks are limited to shallow-draft vessels.

The IHNC lock serves as a link for smaller sized oceangoing vessels moving between the Mississippi River and the IHNC, the GIWW East of New Orleans and the Mississippi River.

The Algiers and Harvey Locks provide the connection between the Mississippi River at New Orleans and the GIWW West of New Orleans.

The Bayou Boeuf Lock on the GIWW (Mile 93 WHL) provides navigation through the levee system which protects areas east of Morgan City, Louisiana, from Atchafalaya River floodwaters.

Ostrica Lock and Empire Lock, both operated by the State of Louisiana, are located between the Head of Passes and the lower port limits of New Orleans. These two small locks provide passage for crewboats, fishing boats, small barges, and recreational craft. Ostrica Lock (Mile 25.2 AHP) is on the left descending bank and connects with Breton Sound, while Empire Lock (Mile 29.5 AHP) on the right bank, connects with the Gulf of Mexico via the Empire Waterway.

Ports

The Port of New Orleans is the major deep-draft port facility in WRPA 10. The port is located on both banks of the Mississippi River in the southeastern part of the State of Louisiana. The lower limit of the port is approximately 81 miles above Head of Passes (AHP). The upper limits on the left and right descending banks are 104 and 115 miles, respectively, above Head of Passes. The distance from the Head of Passes to the Gulf of Mexico is 20 miles via Southwest Pass and 13 miles via South Pass. In general, with the exception of the small community of Algiers on the opposite bank of the river, the city of New Orleans is bounded on the south by the Mississippi River. Lake

Table 70 - Existing Navigation Improvements^{1/}, WRPA 10

Shallow-Draft Channels	Depth feet	Width feet	Length miles	Remarks/Section Included ^{2/}
Barataria Bay Waterway, La.	12	125	41.2	From GIWW Mi. 15 WHL to Gulf of Mexico with side channel to Grand Isle, La.
Bayou Bonfouca, La.	10	60	9.3	From Bayou Bonfouca at Slidell, La. to the -10-foot contour of Lake Pontchartrain.
Bayou Dupre, La.	6	80	7.3	From Violet, La. to -6-foot contour in Lake Borgne. Width 100 feet in Lake; 6-foot X 100-foot X 200-foot turning basin in Violet.
Bayou Lacombe, La.	8	60	8.2	Channel through bar in Lake Pontchartrain only. Remainder of project provides only snag and tree removal to Mile 8.2 at Lacombe, La.
Bayou Lafourche	6 9 12	60 100 125	18 9 14 <u>41</u>	GIWW Mi. 35 WHL to Yankee Canal. Yankee Canal to vicinity of Leeville, La. Leeville, La. to Gulf of Mexico.
Bayous LaLoutre, St. Malo, and Yscloskey, La.	5 5 6 6	30 40 40 40	7 0.25 6.3 15 <u>28.55</u>	Hopedale, La. to junction of Bayous LaLoutre & St. Malo. Bar Channel, Lake Borgne at Shell Beach Bayou St. Malo, Lake Borgne to Bayou LaLoutre. Bayou LaLoutre, Eloi Bay to Bayou St. Malo.
Bayou Segnette Waterway, La.	9	60	12.2	From Company Canal at Westwego, La. to GIWW, Mi. 15 WHL.
Bayou Terrebonne, La.	6	Not Specified	24.1	From Bush Canal (Mi. 12.9) to Houma, La.
Chefuncte River and Bogue Falia, La.	10 8	125 Not Specified	3.5 11.5 <u>15.0</u>	Lake Pontchartrain to vicinity of Madisonville, La.
Grand Bayou Pass, La.	6	60	.5	Bar Channel only.
Gulf Intracoastal Waterway: Mississippi River to Lake Borgne Light 29	12	150	33	This section also includes an alternate 9-foot X 100-foot route through Lake Pontchartrain.
Mississippi River to Atchafalaya River	12	125	95.5 <u>128.5</u>	

Table 70 - Existing Navigation Improvements^{1/}, WRPA 10 (cont'd)

<u>Shallow-Draft Channels</u>	<u>Depth</u> <u>feet</u>	<u>Width</u> <u>feet</u>	<u>Length</u> <u>miles</u>	<u>Remarks/Section Included</u> ^{2/}
Houma Navigation Canal, La.	15	150	36.6	From Houma, La. to Terrebonne Bay.
Little Caillou Bayou, La.	5	40	20	Little Caillou Bayou from Bayou Terrebonne to Robinson Canal.
Michoud Canal, La.	18-50	800	1.5	Non-project channel, at present. Authorized for enlargement.
Waterway from Empire, La. to the Gulf of Mexico	9	80	10	From Empire, La. to -9-foot contour in the Gulf of Mexico.
Waterway from Intracoastal Waterway to Bayou Dulac, La.	5	40	14	Bayou Dulac to vicinity of Houma, La.
	10	45	2	GIWW, Mile 59 WHL to Houma Navigation Canal.
<u>Deep-Draft Channels</u>				
Inner Harbor Navigation Canal (IHNC)	32	300	5.5	From Mississippi River to Lake Pontchartrain.
Mississippi River - Gulf Outlet, La.	36	500	75.4	From IHNC to the -38-foot contour in the Gulf of Mexico.
<u>Ports</u>				
Port of New Orleans, La.	40	1,000	147	Both banks of the Mississippi River from Mile 127 above head of Passes to Mouth of Passes.
	32	300	5.5	From Mississippi River to Lake Pontchartrain.
	36	500	7	From IHNC to Bayou Bienvenue.
	12	125	5.5	GIWW from Mile 0 to Mile 5.5 WHL.
<u>Locks</u>	<u>Depth over Sill</u> <u>feet</u>	<u>Width</u> <u>feet</u>	<u>Length</u> <u>feet</u>	<u>Remarks/Section Included</u> ^{2/}
Algiers Lock	13	75	800	Opened to Navigation in 1956
Bayou Boeuf	13	75	1156	Opened to Navigation in 1954
Empire Lock	10	40	200	Opened to Navigation in 1948
Harvey Lock	12	75	425	Opened to Navigation in 1934
Inner Harbor Navigation Canal Lock (IHNC)	31.5	75	640	Opened to Navigation in 1923
Ostrica Lock	10	40	250	Opened to Navigation in 1952

^{1/} Detailed information on existing projects may be found in Appendix B, Inventory of Facilities.

^{2/} Points on the GIWW are expressed as miles east or west of Harvey Lock in New Orleans (EHL, WHL).



Port of New Orleans

With 25 miles of public and private wharves and other facilities in the port, New Orleans ranks as second port in the nation, being topped only by New York. The public docks can handle up to 85 ships at one time. The port operates on three bodies of water - the Mississippi River (minimum width 2,000 feet and depth of 30 to 200 feet), the Industrial Canal (125 to 300 feet wide and 30 feet deep), and the Mississippi River-Gulf Outlet (a man-made channel 36 feet deep and 500 feet wide which cuts 25 miles from the run to the Gulf).

Pontchartrain and the Rigolets, a connecting link between Lake Pontchartrain and Lake Borgne, are the northern boundary. The Inner Harbor Navigation (Industrial) Canal in the city of New Orleans connects the Mississippi River with Lake Pontchartrain, the Mississippi River Gulf Outlet and the Gulf Intracoastal Waterway east of New Orleans.

Limits of the port encompass all of the parish of Orleans and the river frontage of the parishes of Jefferson and St. Bernard. This includes the towns and communities of Kenner, Harahan, Southport, Arabi, Chalmette, Meraux, and Violet on the left bank; and Avondale, Bridge City, Westwego, Marrero, Harvey, Gretna, and Algiers on the right bank. The frontage for deepwater vessels within the port limits includes approximately 57 miles along the riverbanks, 11 miles on the Inner Harbor Navigation (Industrial) Canal, and approximately 78 miles on the Mississippi River - Gulf Outlet.

Two hundred and ninety-five piers, wharves, and docks are contained within the Port of New Orleans. These are categorized by use in table 71 below:

Table 71 - Port of New Orleans Facilities

<u>Primary Purpose for Which Used</u>	<u>Number</u>
Cargo handling:	
Barite and drilling mud	10
Bulk cement	5
Concrete products (prestressed)	3
Dry bulk commodities	2
Foreign automobiles and rocket stages	2
General cargo - in foreign and domestic trades	42
Grain	7
Gypsum rock	2
Liquid hydrogen and liquid oxygen (one each)	2
Lumber and bananas (one each)	2
Marine construction materials, supplies, and equipment	14
Molasses, alcohol, and chemicals	6
Oil well drilling equipment, supplies, and service	30
Petroleum products, crude oil, petrochemicals, chemicals, phosphoric acid, sodium sulfide, and soybean, fish, vegetable, and tung oils	32
Sand, gravel, and shell	15
Scrap metal, boiler slag, and fertilizer (one each)	3
Seafood	2
Steel and steel products	4
Sugar	1
Landing for passenger and vehicular ferries	6

Table 71 - Port of New Orleans Facilities (cont'd)

<u>Primary Purpose for Which Used</u>	<u>Number</u>
Landing for ship service boats, crews, and passengers from vessels at anchor in harbor	2
Marine services and repairs:	
Fueling tugs and towboats and other types of small vessels	6
Mooring	45
Mooring in connection with marine repairs, conversion, and outfitting	48
Unused facilities at time of survey	4
TOTAL	295

Thirty companies in the port area operate warehouses having a total of 3,012,450 square feet of dry storage space and 3,720,000 cubic feet of cooler and freezer space; all but two of the warehouses have railroad connections, and all are easily accessible to arterial highways.

In addition to the long- and short-term covered storage facilities for waterborne cargo, there are 11 locations, which provide a total of 29.1 acres, improved and available for open public storage.

Two waterfront grain elevators, with a total capacity of 11,387,000 bushels, serve the port and are used primarily for the movement of export grain received by barge and rail. Each elevator is supported by adjoining rail yards and has electrically driven belt conveyors in overhead galleries extending from elevators to dockside.

In addition to the Port of New Orleans, there are several smaller ports within WRPA 10 which have legally constituted harbor and terminal authorities. A list of these is contained in the regional summary.

Navigation Aids

The U. S. Coast Guard maintains all necessary navigation aids on Federally constructed channels and harbors, and marks hazards to navigation.

AUTHORIZED NAVIGATION IMPROVEMENTS

Navigation improvements authorized for Federal construction within WRPA 10 are shown on table 72.

Shallow-Draft Channels

The existing project for Bayou Lafourche was modified by the River and Harbor Act of 1960 to provide: a channel 9 feet deep by 100 feet wide from Golden Meadow, Louisiana, to Leeville, Louisiana; (completed) a channel 12 feet deep by 125 feet wide from the GIWW Mile 37.2 generally parallel to the existing bayou, extending to Bayou Lafourche below Leeville and thence to the Gulf of Mexico; and a 12-foot by 125-foot channel from Leeville eastward to Bayou Gigard in the vicinity of Grand Isle, Louisiana.

The River and Harbor Act of 1962 authorized enlargement of the existing 12 feet X 125 feet GIWW between New Orleans and the Atchafalaya River to dimensions of 16 feet X 150 feet.

The River and Harbor Act of 1968 provided for additional outlets from the Mississippi River at Venice, Louisiana, to shorten the distance from Breton Sound east of the river to that area of the Gulf of Mexico West of the river. These outlets will be provided by enlargement of the existing channels of Baptiste Collette Bayou and Grand-Tigre Pass to dimensions of 14 feet by 150 feet, with entrance channels of 16 feet X 250 feet.

Deep-Draft Channels

The Atchafalaya River-Bayou Chene, Boeuf, and Black project will provide a 20-foot deep by 400-foot wide channel from industrial areas east of Morgan City, Louisiana, to the Gulf of Mexico via existing bayous and the lower Atchafalaya River. The primary purpose of this project is to provide an efficient method of transportation for large prices of mobile offshore oilfield equipment from their bases or construction sites to points in the Gulf of Mexico and elsewhere.

Enlargement of the existing Michoud Canal, located in eastern New Orleans, was authorized by the River and Harbor Act of 1968. The plan of improvement calls for enlarging the canal from the industrial sites at its head to the GIWW and thence to the intersection of the GIWW and the MR-GO. Channel dimensions, as shown on table 72, will be 36 feet X 250 feet, and will include a 36-foot X 800-foot X 800-foot turning basin at the head of the canal.

Table 72 - Authorized Navigation Improvements, WRPA 10

<u>Shallow Draft</u>	<u>Depth</u> feet	<u>Width</u> feet	<u>Length</u> miles	<u>Remarks</u>
Bayou Lafourche and Lafourche-Jump Waterway, La.	6 12	60 125	20 45	Section Included: From Thibodeaux, La. to Lockport, La. Section Included: From GIWW Mi. 37.2 WHL to vicinity of Leeville, La.; and from Leeville, La. to Grand Isle, La.
Gulf Intracoastal Waterway: Mississippi River to Atchafalaya River	16	150	95.5	
Mississippi River, Outlets at Venice, La.	14	150	22	Section Included: Mississippi River at Venice, La. to the Gulf of Mexico via Baptiste Collette Bayou. Mississippi River at Venice to Gulf via Tiger Pass and Grand Pass.
Atchafalaya River - Bayous Chene, Boeuf, and Black, La.	20	400	52	Section Included: Bayous Boeuf and Black at U.S. Hwy. 90 to the 20 contour in the Gulf of Mexico.
Michoud Canal, La.	36	250	2.8	Section Included: From the junction of the GIWW and MRGO to the head of the existing canal. Includes 36-foot X 800-foot X 800-foot turning basin.

Table 72 - Authorized Navigation Improvements, WRPA 10 (cont'd)

<u>Locks</u>	<u>Depth</u> feet	<u>Width</u> feet	<u>Length</u> feet	<u>Remarks</u>
Mississippi River to MR-GO Ship Ship Lock	50 <u>1</u> /	150 <u>1</u> /	1200	This lock will serve as a replacement for the obso- lescent IHNC Lock. Tenta- tive alignment for the new lock and channel extends from the Mississippi River in the vicinity of Violet, La. to the MR-GO at Mile 54.

1/ Recommended.

Locks

The River and Harbor Act of 29 March 1956, which authorized the construction of the Mississippi River - Gulf Outlet, also authorized construction, when economically justified, of a new ship lock and connecting channel to serve as an additional link between the MR-GO and as a replacement for the obsolescent IHNC lock which presently is the only connection between the Mississippi River and the MR-GO, the GIWW east of New Orleans, and Lake Pontchartrain. Tentative alignment for the new channel extends from the Mississippi River just south of Violet, Louisiana (Mile 83 AHP) to the MR-GO at Mile 54.

Ports

The Board of Commissioners of the Port of New Orleans have developed extensive plans which call for the movement of most of the ports' facilities from the Mississippi River to the MR-GO tidewater channel generally in the vicinity of its intersection with the IHNC and eastward for about 5 miles to the I-410 high level bridge. The proposed new facilities are to include container and breakbulk cargo terminals, steel terminals, LASH - and Sea Bee - type barge carrier terminals, a bulk cargo facility (already constructed), and light and heavy industrial sites.

EXISTING COMMERCE

General

Waterborne commerce recorded for WRPA 10 waterways during 1970 is shown by commodities on table 73. Individual commodity movements are discussed in the following paragraphs.

Inland Commerce

Grain

As shown on the table, nearly all shallow-draft grain movements in WRPA 10 involve the GIWW east of New Orleans. These shipments consist almost entirely of corn and soybeans moving from the Ohio and Upper Mississippi River Systems to grain elevators in Pascagoula, Mississippi, and Mobile, Alabama, for eventual export or coastwise shipment.

Coal

WRPA 10 inland coal movements are comprised predominantly of shipments from points on the Ohio River to steam-electric generating plants in Biloxi, Mississippi, and along the Florida Gulf Coast between Pensacola and Panama City.

Petroleum

About 75 percent of shallow-draft petroleum movements in WRPA 10 take place in the portion of the area west of the Mississippi River. These movements consist generally of: crude oil moving from storage and gathering facilities located on the various waterways to the GIWW for ultimate shipment to refineries located in western Louisiana and in Texas and; refined products (chiefly gasoline) moving east from these refineries to population centers served by the Mississippi River and contiguous waterways.

The bulk of shallow-draft petroleum movements in that part of WRPA 10 east of the Mississippi River is made up of refined products, principally gasoline, moving from refineries in New Orleans and Pascagoula, Mississippi, to terminals eastward along the GIWW.

Cement, Stone, Sand, and Aggregate (CSSA)

While it includes cement, sand, and gravel, this category of movements in WRPA 10 consists mainly of unmanufactured marine shells which are used in road construction and maintenance, oilfield construction, and as a raw material in the production of cement. As is reflected in table 73, Lake Pontchartrain is one of Louisiana's major producers of marine shell. After being dredged from the Lake, the shell is moved to storage yards in the New Orleans area by way of the IHNC for eventual reshipment by truck and barge to final use points throughout the surrounding coastal area.

Sulphur

Sulfur movements in WRPA 10 generally originate at pipeline terminals located near Bayou Lafourche and the Barataria Bay Waterway and destined for large storage and processing facilities on the Mississippi River south of New Orleans. From here, the sulfur is further shipped by barge to inland destinations on the GIWW and the Mississippi River and by deep-draft vessels to foreign and domestic ports.

Iron and Steel

The bulk of the WRPA 10 movements under this category are comprised of: steel pipe and tubing used in drilling oil wells and for pipelines; plates and sheets used in ship and boat building, and other construction; and, ores and ferroalloys.

Industrial Chemicals

Significant inland movements of industrial chemicals within WRPA 10 are confined to the GIWW. In the main, these movements originate at chemical and petrochemical plants in southwestern Louisiana and in Texas, and are destined for points served by the Mississippi River. In addition, smaller amounts move from the Mississippi and Alabama Gulf Coast westward to the Mississippi River via the GIWW and the IHNC. Principal types of chemicals involved in these movements are sodium hydroxide, alcohols, solvents, and unclassified basic chemicals.

Table 73 - 1970 Waterborne Commerce, WRPA 10
(Thousand Short Tons)

Waterway or Port	Grain	Coal	Petroleum	Cotton ^{2/}	Sulfur	Inland				General Cargo	Total
						Iron & Steel	Industrial Chemicals	Agricultural Chemicals	Aluminum	Other	
Barataria Bay Waterway, La.	--	--	3,329.4	48.8	1,316.5	33.2	13.9	--	--	--	5,170.2
Bayou Bonfouca, La.	--	--	2.9	21.0	--	6.8	--	--	--	1.2	31.9
Bayou Dupre, La.	--	--	206.1	--	--	--	--	--	--	5.6	211.7
Bayou Lacombe, La.	--	--	--	249.4	--	--	--	--	--	--	249.4
Bayou Lafourche, La.	3.3	--	648.4	332.2	426.2	27.5	34.8	--	--	44.2	2,430.5
Bayous Laloutre, St. Malo, & Yscloskey, La.	--	--	.2	1.6	--	--	--	--	--	--	1.8
Bayou Segnette Waterway, La.	--	--	--	3.7	--	--	--	--	--	.4	4.1
Bayou Terrebonne, La.	--	--	130.2	14.8	--	--	--	--	--	11.1	497.7
Chefunte River & Bogue Falia, La.	--	--	--	18.3	--	2.5	--	--	--	--	20.8
Grand Bayou Pass, La.	No Commerce Reported										
Gulf Intracoastal Waterway: Miss. R. to Lake Borgne Light 29	611.0	1,065.8	6,906.1	2,103.1	270.0	284.0	1,591.5	611.1	--	255.8	14,210.0
Miss. R. to Atchafalaya River	78.0	156.0	16,380.0	2,600.0	203.0	754.0	2,756.0	289.0	--	2,054.0	26,024.0

Table 73 - 1970 Waterborne Commerce, WSPA 10 (cont'd)
(Thousand Short Tons)

Waterway or Port	Grain	Coal	Petroleum	CSSA ² / ₂	Sulfur	Iron & Steel		Industrial Chemicals	Agricultural Chemicals	Aluminum	General Cargo		Total
						Steel	Iron				Other	Cargo	
Inland													
Houma Navigation Canal, La.	--	--	1,897.0	191.0	--	146.0	--	18.0	--	--	2.0	422.0	2,676.0
Inner Harbor Navigation Canal ¹ / ₂	11.5	1.2	625.2	5,352.6	--	332.0	--	188.4	70.1	--	38.6	511.8	7,131.4
Lake Pontchartrain, La.	--	--	50.9	4,673.4	--	27.5	--	--	--	--	--	10.2	4,761.8
Little Bayou Caillou, La.	--	--	679.9	10.8	--	.4	--	.02	--	--	--	26.5	717.6
Mississippi River - Gulf Outlet ¹ / ₂	12.0	1.0	532.0	89.0	--	196.0	--	184.0	69.0	--	34.0	237.0	1,354.0
Waterway from Empire, La. to the Gulf of Mexico	--	--	--	58.0	3.9	4.1	--	1.4	--	--	1.0	104.1	172.5
Waterway from the Intracoastal Waterway to Bayou La Larcade, La.	--	--	27.4	24.4	--	13.2	--	18.7	--	--	--	285.7	369.4
Coastwise													
Inner Harbor Navigation Canal ¹ / ₂	11.2	.01	.4	.04	--	3.1	--	1.9	6.2	.2	12.0	62.2	97.2
Miss. R. - Gulf Outlet, La. ¹ / ₂	11.0	--	1.0	--	--	2.0	--	2.0	6.0	16.4	26.0	73.6	138.0
Foreign													
Inner Harbor Navigation Canal ¹ / ₂	69.8	56.2	29.9	96.8	.03	455.0	--	27.6	46.0	1.0	309.1	207.0	1,298.4
Miss. R. - Gulf Outlet, La. ¹ / ₂	87.0	556.0	28.0	85.0	--	559.0	--	286.0	126.0	141.2	482.0	171.8	2,522.0

Table 73- 1970 Waterborne Commerce, WRPA 10 (cont'd)
(Thousand Short Tons)

Waterway or Port	Grain	Coal	Petroleum	CSSA	Sulfur	Iron & Steel	Industrial		Agricultural		General		Total
							Chemicals	Chemicals	Aluminum	Other	Cargo		
Port of New Orleans:													
Inland	11,890.8	3,845.5	26,058.0	1,887.8	2,041.8	2,822.5	1,613.5	1,872.5	676.6	821.7	6,523.6	60,052.3	
Coastwise	130.4	3,704.5	23,687.0	.4	1,539.2	13.1	180.1	1,469.1	19.7	272.9	390.4	31,406.8	
Imports	26.1	4.5	932.3	157.5	---	1,461.4	393.2	150.9	751.4	1,979.2	1,678.6	7,535.0	
Exports	14,244.1	881.8	604.8	11.7	809.8	2,321.2	702.8	129.8	40.3	76.4	4,857.2	24,679.9	
Total	26,291.4	8,434.3	51,282.1	2,057.3	4,390.8	6,618.2	2,889.5	3,622.3	1,488.0	3,150.1	13,449.8	123,674.2	

1/ Included in Port of New Orleans Traffic

2/ Cement, Stone, Sand, and Aggregate

Agricultural Chemicals

All shallow-draft movements of Agricultural chemicals in WRPA 10 are confined to the GIWW, the MR-GO, and the IHNC. They consist of bulk chemical fertilizer shipments moving from production points west of WRPA 10 through the Port of New Orleans, and shipments moving from New Orleans to points east and west on the GIWW.

Other

The principal commodity moving in WRPA 10 under this heading is bulk salt which originates at mines near the GIWW west of WRPA 10 and is destined for points on the Mississippi and Ohio Rivers and on the GIWW east of New Orleans.

General Cargo

General cargo tonnages include principally miscellaneous manufactured goods, wood pulp, drilling water, drilling mud, miscellaneous non-metallic minerals, food and industrial fish, and other miscellaneous bulk commodities.

Coastwise Trade

The IHNC and the MR-GO both support a small amount of coastwise shipments. In 1970, the bulk of these shipments on the IHNC were comprised of nonmetallic mineral receipts plus through movements of corn, frozen meat, alcoholic beverages, and unclassified commodities. These IHNC through movements, combined with aluminum ores, sugar, and fertilizers also comprised the majority of commerce over the adjoining MR-GO for that year.

Foreign Trade

As with coastwise traffic, foreign traffic over WRPA 10 waterways is limited to the IHNC and the MR-GO. About 75 percent of the 1970 foreign commerce on the IHNC was comprised of commodities under the heading of Iron and Steel, Other and General Cargo. Iron and Steel movements consisted mainly of scrap from a ship-breaker located on the canal, while principal commodities under "Other" and "General Cargo" were nonmetallic minerals, coffee, crude rubber, sugar, vegetable oil, and paper products.

On the MR-GO, three categories, Coal, Iron and Steel, and Other comprised over 60 percent of the 1970 total. Under Coal, about a third of the tonnage was represented by exports of bulk coal and lignite while the remaining two-thirds was made up of coke and petroleum asphalt exports. Over half of the Iron and Steel movements were the exports of scrap mentioned above on the IHNC, with the rest being comprised of imported manganese ore, ferroalloys, and iron and steel

primary forms. Significant tonnages moved under the "Other" classification were imported sugar and through movements of nonmetallic minerals.

The remaining 40 percent of the MR-GO traffic is made up principally of industrial and agricultural chemicals, and imported aluminum ores.

Port of New Orleans

Table 73 shows commercial statistics for the Port of New Orleans during 1970. For the purposes of these statistics, the Port is considered to comprise both banks of the Mississippi River from Mile 127 AHP to the mouth of the passes, the IHNC, 7 miles of the MR-GO, and the Harvey Canal.

Over half of these tonnages represent movements of bulk commodities principally grain, coal, and crude and refined petroleum products. Grain movements are comprised mainly of corn and soybean exports from the seven barge elevators in the port area. Most of the coal shown on the table is moved coastwise from a transfer yard south of New Orleans to Florida by oceangoing barge. About 65 percent of the petroleum tonnage consists of crude oil, most of which is shipped coastwise from storage terminals in the port area. The bulk of the remaining petroleum movements is made up of coastwise and inland shipments of refined products (principally gasoline) from the many refineries located along the Mississippi River.

Significant quantities of iron and steel also move in the Port of New Orleans. In 1970, the three largest movements were imported plates and sheets, exported primary forms, and exported scrap. The large sulphur tonnages shown on the table are comprised of inland and coastwise shipments and exports originating at a large sulphur mining and storage complex on the Mississippi River south of the Port. CSSA movements mainly represent transfers of locally produced marine shell from Lake Pontchartrain. The industrial and agricultural chemical movements are a reflection of the previously mentioned chemical and petrochemical plants located between New Orleans and Baton Rouge and near the MR-GO. The aluminum movements shown for the port are comprised mainly of imported alumina which is transshipped by barge to inland aluminum production facilities. Of the commodity movements included under "Other" virtually all were comprised of sugar, molasses, and nonmetallic mineral tonnages, principally imports. In 1970, the largest movements under "General Cargo" consisted of imported bananas and coffee, and exported grain mill products, vegetable oil, pulp, and paper, and machinery. These items represent about 50 percent of 1970 General Cargo commerce. The remainder was made up of a great variety of break-bulk cargo movements.

VESSEL COMPOSITION

Commercial vessel movements over WRPA 10 waterways are summarized on table 74. Description of typical vessels and tow composition are contained in the regional summary.

FUTURE NEEDS

Prospective Commerce

Waterborne Commerce in the selected commodity categories was projected in accordance with indices of output developed for the appropriate major industry groups. These indices are shown on table 75. In general, the Program A indices represent OBER'S' forecast of economic growth for the individual WRPA's within the Lower Mississippi Region. Program B indices were developed to reflect a regional growth in employment equal to the national average, 1.4 percent^{1/}. Application of these indices to the base year tonnages shown previously on table 73 yield future levels of commerce as shown in aggregate on table 76. These levels are designated as the gross needs of the area. Note that the projections are expressed in ton-miles for the waterways and in short tons for the Port of New Orleans.

Net Needs

Table 77 summarizes the net navigation needs required to support commerce projected for WRPA 10 under Program A and B objectives.

Shallow-Draft Channels

No new shallow-draft channel construction will be required during the study period for WRPA 10. Commerce projected for the GIWW and contiguous waterways, however, will produce net needs for improvements of existing channels as early as 1980. These needs will involve the main stem by the year 2000. Additionally, the fishing and petroleum industries served from bases on the MR-GO and the Mississippi River below the Port of New Orleans will generate net needs for enlargement of existing channels by 1980. Marine shell yards and boat building activities located near the north shore of Lake Pontchartrain will produce a need for channel enlargement by the year 2000.

Deep-Draft Channels

No new deep-draft channels will be required in WRPA 10 during the study period. Industrial activity in areas east of Morgan City,

^{1/} Further discussion of these indices and their derivations is contained in Appendix B, Economics

Table 74 - Vessel Trips, 1970, WRPA 10

Waterway	Inbound/Upbound/Eastbound/Northbound					Outbound/Downbound/Westbound/Southbound						
	Self-Propelled Vessels		Non-Self-Propelled Vessels		Total	Self-Propelled Vessels		Non-Self-Propelled Vessels		Total		
	Dry Cargo & Passenger	Tanker	Tugboat or Towboat	Dry Cargo & Passenger		Tanker	Tugboat or Towboat	Dry Cargo	Tanker			
Shallow Draft												
Barataria Bay Waterway, La.	5,763	1	3,041	1,131	2,751	12,687	5,763	1	3,041	1,130	2,751	12,686
Bayou Bonfouca, La.	2	0	200	179	21	402	2	0	208	194	18	422
Bayou Dupre, La.	291	0	100	0	137	528	291	0	108	0	146	545
Bayou Lacombe, La.	0	0	210	382	0	592	0	0	211	378	0	589
Bayou Lafourche, La.	11,512	0	2,373	1,209	1,130	16,224	11,512	0	2,373	1,206	1,130	16,221
Bayous LaLoutre, St. Malo, & Yscloskey, La.	0	0	16	3	2	21	0	0	15	3	2	20
Bayou Segnette Waterway, La.	940	0	5	5	0	950	940	0	5	5	0	950
Bayou Terrebonne, La.	375	0	1,835	1,509	498	4,217	373	0	1,834	1,510	498	4,215
Chefunte River & Bogue Falia, La.	0	0	40	31	0	71	2	0	41	31	0	74
Grand Bayou Pass, La.	No vessel trips reported											
Houma Navigation Canal, La.	9,084	0	3,833	1,931	1,565	16,413	9,083	0	3,832	1,932	1,565	16,412
Inner Harbor Navigation Canal	451	1	5,804	8,292	559	15,107	449	3	5,805	8,292	560	15,109
Lake Pontchartrain, La.	123	0	4,459	6,308	132	11,022	121	0	4,459	6,317	131	11,028
Little Caillou Bayou, La.	2,611	0	299	45	443	3,398	2,615	0	298	43	445	3,401

Table 74 - Vessel Trips, 1970, WSPA 10 (cont'd)

Waterway	Inbound/Upbound/Eastbound/Northbound				Outbound/Downbound/Westbound/Southbound							
	Self-Propelled Vessels		Non-Self-Propelled Vessels		Self-Propelled Vessels		Non-Self-Propelled Vessels					
	Passenger & Dry Cargo	Tugboat or Towboat	Tanker	Total	Passenger & Dry Cargo	Tugboat or Towboat	Tanker	Total				
Shallow Draft												
Miss. River - Gulf Outlet, La.	500	2	610	615	442	2,169	517	0	610	615	441	2,183
Waterway for Empire, La. to the Gulf of Mexico	5,849	0	382	162	239	6,632	5,848	0	382	162	240	6,632
Waterway from the Intracoastal Waterway to Bayou Dulac, La.	5,294	0	1,082	724	209	7,309	5,295	0	1,082	725	209	7,311
Deep Draft												
Inner Harbor Navigation Canal												
19ft-24ft draft	73	0	0	0	0	73	84	0	0	0	0	84
25ft-30ft draft	68	4	0	0	0	72	58	1	0	0	0	59
Total	141	4	0	0	0	145	142	1	0	0	0	143
Miss. River - Gulf Outlet, La.												
19ft-24ft draft	124	0	0	0	0	124	84	0	0	0	0	84
25ft-30ft draft	80	0	0	0	0	80	98	2	0	0	0	100
31ft-36ft draft	31	1	0	0	0	32	37	0	0	0	0	37
Total	235	1	0	0	0	236	219	2	0	0	0	221

Table 75 - Economic Forecast, WRPA 10
Indices of Productivity by Major Industries

Commodity (Industry Group)	Program	1967	1968	1969	1970	1980	2000	2020
Grain (Agriculture)	A	--	--	--	100	145	172	197
	B	--	--	--	100	145	185	212
Coal (Mining, National)	A	100	104	106	109	143	199	323
	B	100	104	106	109	143	199	323
Petroleum (Mining & Refining, Average)	A	100	121	125	130	178	286	503
	B	100	121	126	132	194	330	594
CSSA (Quarrying)	A	100	110	114	118	163	316	622
	B	100	110	114	120	179	365	734
Sulfur (Quarrying)	A	100	100	100	100	100	100	100
	B	100	100	100	100	100	100	100
Iron & Steel (Primary Metals)	A	100	97	104	107	131	205	332
	B	100	97	106	110	144	247	380
Industrial Chemicals (Chemicals & Allied Products)	A	100	118	125	134	228	677	1,771
	B	100	118	126	138	250	783	2,089
Agricultural Chemicals (Agriculture)	A	--	--	--	100	145	172	197
	B	--	--	--	100	145	185	212
Other Commodities (Chemicals & Allied Products)	A	100	118	125	134	228	677	1,771
	B	100	118	126	138	250	783	2,089
Miscellaneous Commod- ities (Other Manu- facturing)	A	100	108	112	117	172	374	805
	B	100	108	113	120	189	433	949

Table 76 - Present and Prospective Waterborne Commerce, WRPA 10

Waterway or Port	1970		Program A		Program B	
	Commerce	Shallow Draft (Ton-Miles x 1000)	1980	2020	1980	2020
Barataria Bay Waterway, La.	120,618	170,234	306,348	584,598	183,106	677,006
Bayou Bonfouca, La.	196	390	735	1,423	428	1,672
Bayou Dupre, La.	275	309	626	1,133	410	1,327
Bayou Lacombe, La.	1,247	1,723	3,340	6,575	1,892	7,758
Bayou Lafourche, La.	37,187	47,861	89,076	171,417	53,043	197,114
Bayous LaLoutre, St. Malo, Yscloskey, La.	9	13	24	47	14	55
Bayou Segnette Waterway, La.	42	59	122	254	63	294
Bayou Terrebonne, La.	8,960	13,119	28,350	60,757	14,292	71,013
Chefunte R. & Bogue Falia, La.	48	66	125	242	71	280
Grand Bayou Pass, La.						
Gulf Intracoastal Waterway: Miss. R. to L. Borgne Lt. #29	397,880	539,336	901,684	1,602,440	567,000	1,811,292
Miss. R. to Atch. River	1,964,812	2,791,612	5,115,653	10,054,788	2,944,424	11,079,247
Houma Navigation Canal, La.	74,928	104,720	189,728	369,292	112,392	427,812
Inner Harbor Navigation Canal	27,905	38,454	71,413	137,268	41,258	152,849
Lake Pontchartrain, La.	99,999	138,050	266,956	524,660	149,054	608,787
Little Caillou Bayou, La.	905	1,299	2,714	5,675	1,399	6,561
Miss. R. - Gulf Outlet, La.	32,089	44,509	83,993	167,962	49,201	230,862
Miss. R. Outlets, Venice, La.	--	16,100	19,000	20,000	16,100	20,000

- No Commerce Reported -

Table 76- Present and Prospective Waterborne Commerce, WRPA 10 (cont'd)

Waterway or Port	1970 Commerce	Program A		Program B	
		1980	2020	1980	2020
Waterway from Empire, La. to the Gulf of Mexico	983	1,412	2,957	1,542	3,400
Waterway from the Intracoastal Waterway to Bayou Dulac, La.	5,703	8,202	17,088	11,066	19,612
TOTAL	2,773,786	3,917,468	7,099,932	4,146,755	7,844,507
		Coastwise (Ton-Miles x 1000)			
Atch. R. - Bayous Chene, Boeuf and Black, La.	--	61,800	81,900	61,800	81,900
Inner Harbor Navigation Canal	224	334	704	353	792
Miss. R. - Gulf Outlet, La.	8,791	12,805	27,968	14,079	35,486
Subtotal	9,015	74,938	110,572	76,232	118,178
		Foreign (Ton-Miles x 1000)			
Atch. R. - Bayous Chene, Boeuf, and Black, La.	--	26,500	35,100	26,500	35,100
Inner Harbor Navigation Canal	2,986	4,260	8,888	4,525	9,982
Michoud Canal, La.	--	905	1,471	905	1,471
Miss. R. - Gulf Outlet, La.	160,677	225,087	452,850	252,100	567,528
Subtotal	163,663	256,752	498,309	284,030	614,081
TOTAL	172,678	331,690	608,881	360,262	752,259
		1,138,120	1,278,978	1,341,752	1,517,599

Table 76 - Present and Prospective Waterborne Commerce, WRPA 10 (cont'd)

<u>Waterway or Port</u>	<u>1970 Commerce</u>	<u>Program A</u>		<u>Program B</u>	
		<u>1980</u>	<u>2000</u>	<u>1980</u>	<u>2000</u>
		<u>Ports</u>			
		<u>(Short Tons x 1000)</u>			
		<u>Shallow Draft</u>			
Port of New Orleans, La.	60,052	79,188	130,770	231,894	86,276
		<u>Coastwise</u>			
	31,407	40,752	64,812	112,101	45,686
		<u>Foreign</u>			
	32,215	42,960	72,858	130,676	45,589
		<u>Totals</u>			
	123,674	162,900	268,440	474,671	177,551
					323,519
					622,664

Table 77 - Navigation Needs, WSPA 10

Item	Program A			Program B		
	1970	1980	2000	1980	2000	2020
Deep-draft Channels (10 ⁶ Ton-Miles)						
New Channels						
Gross Need			NONE		NONE	
Existing Supply						
Net Need						
Existing Facilities Improvement						
Gross Need	0	89.2	118.5	89.2	118.5	131.4
Existing Supply	0	0	0	0	0	0
Net Need	0	89.2	118.5	89.2	118.5	131.4
Shallow-draft Channels (10 ⁶ Ton-Miles)						
New Channels						
Gross Need			NONE		NONE	
Existing Supply						
Net Need						
Existing Facilities Improvement						
Gross Need	0	64.0	6,435.5	69.1	7,182.3	13,801.4
Existing Supply	0	0	0	0	0	0
Net Need	0	64.0	6,435.5	69.1	7,182.3	13,801.4
Deep-draft Navigations Locks (# Ship Lockages)						
Gross Need	242	777	960	777	960	1,140
Existing Supply	242	365	365	365	365	365
Net Need	0	412	595	412	595	775
Shallow-draft Navigation Locks (10 ⁶ Tons)						
Gross Need	48.8	66.8	119.7	70.6	133.0	225.8
Existing Supply	48.8	65.0	78.0	67.0	78.0	78.0
Net Need	0	1.8	41.7	3.6	55.0	177.8

Table 77 - Navigation Needs, WSPA 10 (cont.)

Item	Program A			Program B		
	1970	1980	2000	1980	2000	2020
Deep-draft Harbors and Ports (10 ⁶ Tons)						
Gross Need					NONE	
Existing Supply						
Net Need			NONE			
Shallow-draft Harbors and Ports (10 ⁶ Tons)						
Gross Need					NONE	
Existing Supply						
Net Need			NONE			

Louisiana, however, will generate a need for enlargement of existing deep-draft waterways by 1980. In addition, deep-draft tonnages projected for points on the Mississippi River below Baton Rouge will create a need for enlargement of the existing access route to the Gulf of Mexico. These net needs are presented in the WRPA 1 section. Future studies, however, may indicate that the portion of the route below New Orleans may be more advantageously located in the MR-GO. In this case, that part of the needs proportional to the length of the route via the MR-GO would be assigned to WRPA 10.

Locks

Shallow-draft locks. There currently exists a need for a shallow-draft connection between the GIWW east of New Orleans and the Mississippi River. In addition, the tonnages projected for the GIWW west of the Mississippi River will generate a need for replacement and/or rehabilitation of locks along the WRPA 10 section of that waterway beginning in the year 2000.

Deep-draft locks. Increases in the sizes of ships combined with planned port development along the IHNC has created an existing need for a deep-draft lock connecting the MR-GO and the Mississippi River.

Harbors and Ports

There are no net harbor or port needs projected to develop in WRPA 10 within the study period.



LOCATION MAP



LOWER MISSISSIPPI REGION
COMPREHENSIVE STUDY

**MAJOR STREAMS AND
NAVIGABLE WATERWAYS**
WRPA-10

FIGURE 11

M E T H O D O L O G Y

EXISTING WATERBORNE COMMERCE

A comparative rate analysis of all modes of transportation competing for a region's commerce is beyond the scope of a Type I study; therefore, this study was limited to an analysis of the waterborne commerce moving in and out of the region. The 1970 traffic served as the base year from which to project the 50-year growth (1970-2020) of waterborne commerce for each of the ten water resource planning areas (WRPA) within the region.

The 1970 tonnages were categorized into 10 to 12 commodity groupings, depending on the commodity volume moving over the particular waterway. The commodity groupings used are shown below:

- | | |
|--|---------------------------|
| (1) Grain | (7) Industrial Chemicals |
| (2) Coal | (8) Agriculture Chemicals |
| (3) Petroleum | (9) Aluminum |
| (4) Cement, stone, sand, and gravel (CSSA) | (10) Wood and paper |
| (5) Sulphur | (11) Other |
| (6) Iron & Steel | (12) General Cargo |

The Commodity Classification for Shipping Statistics developed by the Office of Statistical Policy, Office of Management and Budget, was used with some modifications, for categorizing individual commodities under the selected groupings. The commodity classifications are shown in table 78.

PROJECTION PARAMETERS

Future growth indicators were developed in the Appendix B, Economics, for each WRPA. Appraisal of the region's growth was approached from both the point of National Income efficiency (Program A) and that of Regional Development (Program B). "OBERS" indices of output by industry type were selected to provide the factors for projecting most of the waterborne commerce under the Program A appraisal. Indices were constructed by OBERS for each individual WRPA in the Lower Mississippi Region, as well as average growth factors for the nation.

Program B is based on a forecast developed in the Appendix B, Economics, for the future economy of the Lower Mississippi Region. Essentially, it is based on the assumption that the region will grow economically at the same rate as that projected for the nation by the Water Resources Council. Rationale for the development of Program B factors can be found in the Economics Appendix.

Commodity movements within each WRPA were examined as to their origins and destinations before assigning an economic indicator to the commodity grouping. If a particular commodity grouping was made up mostly of through movements from several areas outside of the Lower Mississippi Region, an "OBERS" index for the nation was used for both Program A and B rather than one for the particular WRPA. In some instances the projected growth patterns for other areas were assigned where that projected tonnage would exert significant influence on the Waterborne Commerce in the Lower Mississippi Region. An example of this would be the projected grain movements through Lock 26 in the Upper Mississippi River Basin destined for Gulf ports.

Another departure from the use of indices of output by industry type for projections was in the sulphur commodity grouping. In this analysis sulphur movements are projected to remain constant throughout the study period. Both the United States and world wide inventories are high, and the accumulation of stocks are expected to increase even more. According to Resources For the Future, Inc., the end is not in sight. In its publication, Resources, Some Highlights of 1970, the article stated, "...

By 1970, production of 'recovered' sulfur (that is, sulphur obtained as a by-product of natural gas extraction, oil refining, etc.) exceeded Frasch sulphur for the first time. Given the Canadian potential alone, and the inevitability of sulphur production if the gas is to be sold, it is difficult to see what could reverse the trend. Moreover, it is expected that in the more distant future sulfur supplies can be recovered from a totally new source: extraction - before or during combustion - from fossil fuels, so that their use will contribute less to air pollution. These supplies could eventually outpace all other sources of supply."

PROJECTION UNITS

The 1970 base year commodity groups for each waterway or port within a WRPA are presented in short tons. In projecting the future commerce for the individual waterways, the tonnage projections have been converted to a ton-mile basis to avoid misrepresentation of the tonnage figures when summing up the total commerce for each WRPA or region. The 1970 average length of haul for all commodities moving over the individual waterways was applied to the projected tonnage figures for each waterway to derive the ton-mile projections.

NEEDS

All available survey reports were inventoried as an aid in determining present and future needs for the harbors, ports, and waterways in the region. Lock replacement needs were determined by relating the projected tonnages to recent lock capacity studies on existing structures in the system. The study involved the application of the queueing theory which provides the means of relating tonnage and waiting time to other factors such as tow configuration, equipment size, waterway characteristics, and lockage time.

The gross need for the combined waterways in each WRPA are shown in the Needs Tables under the heading "New Channels," deep- and shallow-draft. These ton-mile needs are the projected commerce expected to move over the existing waterways. Included is an increment of commerce that will require construction of new waterways in order to move via that mode of transportation. The net needs under "New Channels" identify that increment of commerce. The ton-mile figures shown in "Existing Supply" denote the ability of the existing waterways to move the commerce projected for those waterways.

Long range water needs point to the eventual enlargement of many of the existing channels with the region. This would permit deeper loading of existing equipment and future enlargement of barge sizes to take advantage of the economies of scale. These needs are presented in the tables under the heading of "Existing Facilities Improvement," deep- and shallow-draft. Both the gross and net needs shown under this heading represent that portion of the total ton-miles shown in the new channel category that could benefit from enlargement of the existing channels.

Table 78 - Waterborne Commerce Commodity Classification

<u>Grain</u>	<u>Industrial Chemicals</u>
0102 - Barley and Rye	2810 - Sodium Hydroxide
0103 - Corn	2811 - Crude products
0104 - Oats	2813 - Alcohols
0105 - Rice	2818 - Sulphuric Acid
0107 - Wheat	2819 - Basic chemicals, not elsewhere classified
0111 - Soybeans	2821 - Plastic materials, etc.
	2851 - Paints, varnishes, etc.
	2876 - Insecticides, etc.
	2891 - Miscellaneous products
<u>Coal</u>	<u>Agricultural Chemicals</u>
1121 - Coal and Lignite	1471 - Phosphate Rock
3313 - Coke	1479 - Nat. Fertilizer Materials
	2871 - Nitrogenous fertilizer
	2872 - Potassic fertilizer
	2873 - Superphosphate
	2879 - Fertilizers, not elsewhere classified
<u>Petroleum and Petroleum Products</u>	<u>Aluminum</u>
1311 - Crude Petroleum	1051 - Aluminum Ores, Concentrates
2911 - Gasoline	3324 - Aluminum alloys, unworked
2912 - Jet Fuel	
2913 - Kerosene	
2914 - Distillate Fuel Oil	
2915 - Residual Fuel Oil	
2916 - Lubricating oils & greases	
2917 - Naptha, mineral spirits, solvents	
2918 - Asphalt, tar, pitches	
2921 - Liquefied Petroleum gases, coal, gases, natural gas, and natural gas liquids	
2991 - Petroleum & coal products, not elsewhere classified	
<u>CSSA</u>	<u>Wood and Paper</u>
0931 - Marine Shells, unmanufactured	2411 - Logs
1411 - Limestone	2412 - Rafted Logs
1412 - Building stone	2413 - Fuel wood, charcoal, and wastes
1442 - Sand, gravel, crushed rock	2414 - Timber, posts, poles, piling and other wood in the rough
3241 - Building cement	2415 - Pulpwood, log
	2416 - Wood chips, staves, moldings, and excelsior
	2421 - Lumber
	2431 - Veneer, plywood, and other worked wood
	2491 - Wood manufactures, not elsewhere classified
	2611 - Pulp
	2621 - Standard newsprint paper
	2631 - Paper and paperboard
<u>Sulphur</u>	
1492 - Sulphur, dry	
1493 - Sulphur, liquid	
<u>Iron and Steel</u>	
1011 - Iron ore and concentrates	
1061 - Manganese ores and concentrates	

Table 78- Waterborne Commerce Commodity Classification (cont'd)

<u>Iron and Steel</u>	<u>Wood and Paper</u>
3311 - Pig Iron	2691 - Pulp, paper and paperboard products, not elsewhere classified
3314 - Iron and Steel ingots & forms	
3315 - I & S Bars, rods, angles, etc.	
3316 - I & S Plates & sheets	
3317 - I & S Pipe and tube	<u>Other</u>
3318 - Ferro alloys	1499 - Nonmetallic minerals except fuels, not elsewhere classified
3319 - I & S Products, not elsewhere classified	
4011 - I & S Scrap	2061 - Sugar
	2062 - Molasses
	3271 - Lime
	3312 - Slag
	<u>General Cargo</u>
	All remaining 4-digit categories

G L O S S A R Y

Barge - A flat-bottomed vessel, usually non-self propelled, used chiefly on inland waterways for the transport of commodities.

Break-Bulk Cargo - All non-bulk cargo loaded or unloaded by port crane or shipboard gear.

Bulk Freight - Basic commodities in their raw or semi-processed form, that are not sacked, boxed, bundled, or otherwise assembled, but which are carried loose in vessels of transport.

Canal - An artificial watercourse for navigation.

Cargo - The lading of a vessel, railcar, or vehicle.

Carrier - An individual, partnership, or corporation engaged in the business of transporting goods.

Common carrier - A transportation line engaged in the business of transporting persons or goods for compensation and providing services for all shippers impartially.

Contract carrier - Those for-hire carriers which do not hold themselves ready to serve the general public but instead serve one or a few shippers under specific contracts; not subject to regulations as to publication of rates.

Coastwise Service - Considered to be movement by water to and from points on the Atlantic Coast, Gulf Coast, or Pacific Coast, also includes service between U. S. seacoast ports and Puerto Rico, Virgin Islands, Hawaii, and Great Lake ports.

Commodity - Any article of commerce or trade that can be transported and has economic value.

Container - Anything in which articles are packed; specifically a large metal receptacle which may be transferred readily from one vehicle to another, and specifically designed to facilitate coordination and transportation of commodities.

CSSA - Commodity grouping that includes cement, stone, sand, shell, and aggregate.

Deep Draft - Vessels having maximum drafts in excess of 18 feet; also navigation channels designed to accommodate such vessels.

Domestic Shipping - Composed of coastwise, intercoastal, Great Lakes, and inland water transportation. Also includes Puerto Rico and the Virgin Islands.

Draft (Vessel) - The number of feet or inches below the water line that a vessel is submerged.

Existing Supply - Identifies the ability of the existing facilities (waterways, locks, etc.), in ton-miles or tons, to accommodate the projected commerce for each period. It does not reflect the maximum capacities of the facilities.

Exports-Imports - These terms apply to traffic between the United States and foreign ports, including the Panama Canal Zone.

Flotilla Tow - A string of 20-40 barges, three to six abreast.

Freight - Merchandise hauled by transportation lines.

Harbor - A port or haven where vessels anchor; part of a body of water protected and deep enough to furnish safe anchorage.

Inbound-Outbound Traffic - Traffic moving from one waterway into another is termed outbound in the case of the shipping waterway and inbound with respect to the receiving waterway.

Inland Waterway Navigation - Use of navigable rivers and canals, including the intracoastal waterways, for movement of commodities.

Integrated Tow - An assembly of several barges designed in such a way that the underwater shape takes on the appearance of a single vessel (lead barge has easy rake and square stern; middle barges square at both ends; end barge has square bow and short rake on stern).

Intercoastal Waterway Transportation - Embraces all movements which involve transit between U. S. coasts.

Internal Receipts and Shipments - These terms apply to traffic between ports or landings wherein the entire movement takes place on inland waterways.

Intracoastal - Being within and close to the coast or belonging to the inland waters near the coast.

Knot - The nautical mile (6,076 feet); one nautical mile/hour.

Lash Ship (Lighter Aboard Ship) - A cargo vessel designed primarily to carry 40-80 loaded lighters (barges) from port to port; has a traveling gantry crane for hoisting lighters out of water and storing aboard ship. Barge dimensions are generally 61 feet in length and 31 feet in width. Also accommodates containers.

Local Traffic - Movements of freight within the confines of a port whether the port has only one or several arms or channels.

Lock - An inclosure with gates at each end used in raising or lowering vessels as they pass from level to level.

Mini Ship - A small cargo ship (215 feet X 50 feet X 16 feet). Capable of calling at inland ports where minimum channel depths of 9 feet are provided; has self-loading and unloading capabilities.

Nautical Mile - Any of various units of distance used for sea and air navigation based on the length of a minute of arc of a greater circle of the earth*. U.S. now officially uses 6,076.116 feet (international agreement). Britain uses 6,080 feet as the unit.

Port - A harbor town or city where vessels may take on or discharge cargo; haven where vessels may anchor or moor.

Private Carrier - Any person other than a common or contract carrier who transports commerce or property of which such party is the owner, when such transportation is in the furtherance of any commercial enterprise.

Program A - Economic projections made to identify navigation needs based on national income objective parameters.

Program B - Economic projections made to identify navigation needs based on regional accelerated development parameters.

Ro-Ro Ship (Roll-On/Roll-Off) - A cargo vessel designed to permit cargo trailers with wheels and other vehicles to be driven aboard ship rather than being hoisted aboard the vessel.

Seabee Ship - A cargo vessel designed primarily to carry 38 loaded lighters (barges) from port to port; has a stern elevator for lifting barges out of water and storing aboard ship. Barge dimensions are 97.5 feet in length and 35.0 feet in width. Also accommodates containers.

Shallow Draft - Vessels having a maximum draft of 18 feet or less; also navigation channels designed to accommodate such vessels.

Through Traffic - Traffic moving through a waterway to and from points on other waterways.

* Values differ because the earth is not a true sphere.

Ton-Mile - A statistical term defined as one ton of freight carried one statute mile or its equivalent, i.e., one-half ton carried 2 statute miles.

Tonnage - Number of long or short tons of freight handled.

Cargo tonnage - Tons of weight or measurement tons of space; within U. S. the weight measurement = 2,000 pounds (short or net ton); elsewhere usually 2,240 pounds (long or gross ton); measurement ton is usually 40 cubic feet.

Deadweight tonnage - The number of long tons (2,240 pounds) of cargo, stores, bunker fuel, and crew carried by a ship when loaded to her maximum summer loadline.

Displacement tonnage - The weight in long tons (2,240 pounds) of water displaced by the ship when afloat; "light" displacement is the weight without fuel, passengers, and cargo.

Gross ton (vessel) - Applies to the volume of the vessel itself and not to its cargo carrying capacity by weight. It is determined by dividing by 100 the contents, in cubic feet, of the vessels closed-in spaces. A vessel ton is 100 cubic feet; register ton.

Gross ton (weight) - 2,240 pounds; long ton.

Long ton - 2,240 pounds; gross ton.

Measurement ton - 40 cubic feet.

Metric ton - 2,204.6 pounds.

Net ton - 2,000 pounds; short ton.

Net tonnage (vessel) - A vessel's gross tonnage minus deductions for space occupied by accommodations for crew, machinery for navigation, the engine rooms, and fuel. It represents the space available for the accommodation of passengers and the stowage of cargo.

Register ton - 100 cubic feet; gross ton (vessel).

Short ton - 2,000 pounds; net ton.

Vessel ton - 100 cubic feet; gross ton (vessel).

Towboat - A compact shallow-draft vessel with square bow and towing knees for pushing tows of barges on inland waterways, having an almost flat bottom, and usually, conventional doors and windows.

Traffic - Passengers or cargo carried by transportation; the movement of vessels or equipment over the waterways.

Traffic Density - The amount of traffic handled per mile within a given region.

WRPA - Water resource planning area subdivisions (10) of the Lower Mississippi Region.